THE UNIVERSITY OF ALBERTA

DETERMINANTS OF PROVINCIAL AND MUNICIPAL GOVERNMENT EXPENDITURE, CANADA, 1962-1964

BY

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled DETERMINANTS OF PROVINCIAL AND MUNICIPAL GOVERNMENT EXPENDITURE, CANADA, 1962-1964 submitted by Ronald Stratton Edwards in partial fulfilment of the requirements for the degree of Master of Arts.

ABSTRACT

This paper outlines the variation in combined provincial and municipal government expenditure by functional category among the provinces of Canada for the years 1962, 1963 and 1964. Some of the variation in expenditure can be explained by variation in the level of government performing the service, differences in political attitudes, and differences in economic and demographic factors.

Simple correlation and multiple regression techniques are used to test the influence of various factors on government expenditure. Time-series and cross-section data are pooled by means of dummy variables to increase the number of observations.

The individual expenditure categories appear to be influenced by different underlying factors. Five variables, however, appear most significant in influencing several functions. These variables are personal income, non-tax revenue, value added by manufacturing, rate of population growth and federal government conditional grants-in-aid.

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CHAPTER I

DETERMINANTS OF PROVINCIAL AND MUNICIPAL GOVERNMENT EXPENDITURE

Introduction

Combined provincial and municipal government expenditure of the 10 provinces in Canada amounted to $5,834 million in 1962, $6,215 million in 1963, and $6,900 million in 1964.[1] There were striking differences in per capita expenditure among the provinces in total expenditure and on the various functional categories of expenditure. This study investigates the differences in expenditure and attempts to identify some factors which could account for the variation.

Several studies of the determinants of state and local government expenditure have been undertaken in the United States but few studies of factors affecting provincial and municipal government expenditure have been conducted in Canada.[2] This study attempts to add to the state of knowledge in this field for Canada. The Canadian data present some statistical problems because of the small sample size.

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[1] Dominion Bureau of Statistics, Consolidated Government Finance, 68-202, 1962 to 1964, (Ottawa: Queen's Printer, 1962, 1963, 1964), Table 7.

[2] See, for example, H.E. Brazer, City Expenditure in the United States, (New York: National Bureau of Economic Research, 1959); S. Fabricant, The Trend of Government Activity in the United States Since 1900, (New York: National Bureau of Economic Research, 1952); S. Sacks and R. Harris, "The Determinants of State and Local Government Expenditures and Intergovernmental Flows of Funds", National Tax Journal, XVII (1964), pp. 75 - 85; and E.J. Hanson, Fiscal Needs of the Canadian Provinces, (Toronto: Canadian Tax Foundation, 1961).

Dummy variables are employed to increase the sample size from 10 to 30 observations. The use of dummy variables in such a manner has not been common in other studies of the determinants of government expenditure.

Economic factors which are expected to influence the level of government spending, and mathematical techniques employed in the study are outlined in Chapter I. The factors hypothesized to influence expenditure are investigated by means of simple correlation methods and the results are presented.

Chapter II considers the differences in expenditure on education, health, social welfare, and transportation. Some factors associated with these individual expenditure categories are investigated with the aid of multiple regression techniques. Expenditure on natural resources, debt, sanitation, protection, recreation, general government, and total expenditure is considered in Chapter III. The final chapter summarizes the developments of the previous chapters and indicates the more important conclusions of the study.

Scope and Method

Public expenditure levels are determined by the interaction of two opposing forces, namely, the demands of the public and their willingness to provide funds through taxation and other levies. Public demands are determined by the sum of individual sets of preferences. These preferences include the basket of goods and services desired by an individual and involve his philosophy of the appropriate role of the government sector in society. These demands are weighed by politicians who have to balance the differing demands and the degrees of willingness to supply funds of various groups. The response of the government is partly determined by the institutional framework through which the demands must be transmitted from the individual to the government.

The hypothesis that expenditures in the private sector lead to expenditures by the public sector, is tested for expenditures on education, health, transportation and recreation. The variables chosen to represent private expenditure were found to be significant in explaining variation in expenditure only in the latter two functions. This concept, which may be defined as merit wants, is discussed in more detail in the appropriate chapters.

The second category of determinants of expenditure may be thought of as supply variables. Monies available from higher level governments for specific purposes induce local officials to spend money on the aided functions rather than on projects more desirable on other grounds. Revenue from non-tax sources is expected to have a positive influence on spending.

Public decisions to provide certain programs or services are translated into purchases of goods and services, the prices of which may vary from province to province depending upon local supply and

demand conditions in the private sector. Variation in expenditure may arise solely because of price differences as well as from differences in the quantity or quality of services provided. These variables which are difficult to quantify are, with the exception of education expenditure, not included in this study.

The results of the multiple regression analysis must be carefully analyzed in the light of weaknesses in the regression procedure. Such weaknesses arise from inadequate data; accounting methods tend to emphasize statutory rather than purpose functions and there may be variations in the accounting treatments of similar items of expenditure among the municipal and provincial governments. The revenue and expenditure categories are consolidated by the Dominion Bureau of Statistics, but problems of comparability of public finance data is recognized by the Bureau as a major problem. The lack of standardization of government finance terminology leads to difficulties in the statistical application of municipal data because of the lack of integration of accounting terms with those of the federal government. One of these problems is the variation among provinces and municipalities in the types of expenditures that are defined as capital and current. Current expenditures should include a part of the cost of projects such as school buildings which last more than one year but not the total cost in the year it was built. The actual amount charged to current expense of such capital projects varies from government to government. While it would be desirable to study the determinants of current and capital expenditure separately, the data are such that the variables would not be sufficiently accurate to provide for a meaningful analysis. In this study the current and capital expenditures are combined.

The functions which different levels of government perform differ from province to province. Thus in Newfoundland, for example, education is almost entirely a provincial responsibility, while in other provinces expenditure is shared almost equally between the provincial and the municipal governments. It is for this reason that the expenditures and revenues of the two levels of government have been combined. The expenditures and revenues are those of the fiscal year ending nearest to December 31 of the appropriate year. For the provincial government the fiscal year ends March 31, while most municipal governments operate on a calendar year. Thus the data are not strictly comparable, but they are the best available.

The expenditures and revenues are net of transfers between the provincial and municipal governments. Federal government grants-in-aid and shared-cost contributions have been eliminated from the revenue and related expenditures of the provincial governments. This analysis is thus free of the criticism that the same variable is included on both sides of the regression equation, as for example, federal conditional grants for social welfare as an independent variable and expenditures from this money as part of the dependent variable.

The mathematical relationship between the variables may take many forms. Two forms are examined in this study; namely, a linear model where the variables are assumed to change in direct proportion, and a double logarithmic model which yields a measure of percentage changes. These two somewhat arbitrary models are used because of the easier explanation of results. It should be kept in mind, however, that other more complex equations may better fit the data.

This study is a cross section analysis of the variation in provincial and municipal government expenditure among the ten provinces of Canada. Because ten observations is a statistically small sample size, it was decided to increase the sample to thirty observations by pooling cross section and time series data. The years covered are 1962, 1963 and 1964. This is accomplished by defining two dummy variables D_2 and D_3 with the following properties.

D_2 = 1 if 1963
0 if 1962 or 1964

D_3 = 1 if 1964
0 if 1962 or 1963

A matrix of simple correlation coefficients between all variables was then calculated. The relationships between the revenue and expenditure categories, between the expenditure categories and explanatory variables, and among the explanatory variables themselves was examined. The results of the simple correlation analysis were used as a guide in the final selection of variables which were to enter the multiple regression analysis.

The first regression model is linear in the original variables. The dummy variables are incorporated as follows: in 1962

$$Y_1 = A_1 + B_1X_1 + B_2X_2 + \ldots + B_nX_n + u$$

where Y_1 = per capita expenditures

B_n = regression coefficient of explanatory variable X_n.
u = stochastic disturbance team

Similarly, in 1963,

$$Y_1 = A_2 + B_1X_1 + B_2X_2 + \ldots + B_nX_n + u$$

and in 1964,

$$Y_1 = A_3 + B_1X_1 + B_2X_2 + \ldots + B_nX_n + u$$

We combine these three equations into one equation by defining dummy variables D_2 and D_3 so our equation is

$$Y_1 = A_4 + A_5D_2 + A_6D_3 + B_1X_1 + B_2X_2 + \ldots + B_nX_n + u$$

This equation is then estimated by ordinary least squares methods.[3]

The intercepts corresponding to the years 1962, 1963, and 1964 are A_4, $A_4 + A_5$, and $A_4 + A_6$, respectively. The implication of this procedure is that the B coefficients do not change over time which further implies no structural changes occurred between 1962 and 1964 which would affect the coefficients.

The model specified above assumes that the relationship among the variables is additive. This means that the impact of the explanatory variables is found by adding the separate effects of the individual variables. Kurnow[4] has noted that an additive model implies that a change in an expenditure variable resulting from a unit change in one of the explanatory variables is the same, regardless of the level of the other explanatory variables in the equation. For example, the additive model implies that a province with a high level of one variable, say X_1, would incur the same change in expenditure for a given change in variable X_2, as would a province with a lower level of X_1. Such an assumption may be open to question. The province with the higher level of X_1 may incur a larger change in expenditure.

A second model is used in this study to determine the change in the expenditure variable for any combination of explanatory variables rather than the individual effects of each one. This model involves a

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[3] See, for example, J. Johnston, Econometric Methods, (New York: McGraw-Hill, 1963), Chapter 4.

[4] E. Kurnow, "Determinants of State and Local Expenditures Re-examined", National Tax Journal, XVI (1963), 252-55.

logarithmic transformation of both the dependent and independent variables. The dummy variables are first changed to 1 and the natural number "e" such that

$$D_2 = \begin{matrix} e \text{ if } 1963 \\ 1 \text{ otherwise} \end{matrix}$$

$$D_3 = \begin{matrix} e \text{ if } 1964 \\ 1 \text{ otherwise} \end{matrix}$$

The equation is of the form

$$Y_1 = e^{A_4} D_2^{A_5} D_3^{A_6} X_1^{B_1} X_2^{B_2} \ldots X_n^{B_n} e^u$$

Taking logarithms to the base e, the estimating equation is

$$\log Y_1 = A_4 + A_5 \log D_2 + A_6 \log D_3 + B_1 \log X_1 + B_2 \log X_2 + \ldots + B_n \log X_n + u$$

$$\log D_2 = \begin{matrix} 1 \text{ if } 1963 \\ 0 \text{ otherwise} \end{matrix}$$

$$\log D_3 = \begin{matrix} 1 \text{ if } 1964 \\ 0 \text{ otherwise} \end{matrix}$$

The coefficients can, in this case, be interpreted as elasticities.

$$\text{Elasticity} = B = \frac{dY}{Y} \div \frac{dX}{X}$$

that is, $$\frac{dY}{Y} = B \frac{dX}{X}$$

The coefficient B clearly represents the percentage change in the dependent variable, given a one percent change in the explanatory variable. If B were greater than unity the change in the dependent variable is greater than the change in the explanatory variable; this coefficient would be termed elastic. If B were between zero and unity, then per capita expenditure responds in the same direction as the change in the explanatory variable but the percent change is less than the

percent change in the independent variable; this is termed inelastic. If B were less than zero, this indicates that per capita expenditure responds in a direction opposite to that of the explanatory variable.

All regressions in this study were subjected to the "F" test to determine the significance of the regression. Equations which were not significant at the .01 level are not reported in this study. The individual B coefficients were tested by the "t" statistic.

The coefficient of multiple determination, R^2, is the ratio of the explained variance to the total variance of the dependent variable. It provides a measure, in percentage terms, of the proportion of variation in the dependent variable explained by the explanatory variables. This coefficient is biased upwards, and an adjusted coefficient of multiple determination, $\bar{R}^2$, is reported in this study. The adjustment factor is

$$\bar{R}^2 = 1 - \frac{n - 1}{n - (k + 1)} (1 - R^2)$$

where n = number of observations

k = number of explanatory variables

Results of the Simple Correlation Analysis

The degree of association between the functional expenditure categories is shown in Table 1. Correlation between expenditure categories would suggest that the variation in provincial and municipal government expenditure is to some extent similar for the various functions. The higher the value of the simple correlation coefficients, the greater is the likelihood that the variation can be explained by the same underlying factors.

Social welfare expenditure appears to be unrelated to expenditure on all other major functions. There are with the exception of "other" expenditure, no correlation coefficients significantly different from zero at the .05 significance level and there is negative correlation between welfare expenditures and transportation, sanitation, and recreation and cultural expenditures. Health expenditures appear to be unrelated to expenditures in other areas with no coefficients greater than 0.50. Education, sanitation, general government, protection to persons and property and recreation expenditures appear to be statistically interrelated and thus one might expect these categories to be influenced by similar factors. The other functions show a lesser degree of statistical interrelation. In general, there is not a high degree of association between the various functions. This suggests an individual analysis of each function.

Demographic factors such as population size and density influence both the demand for government services and the difficulty of supplying services. The effect of these explanatory variables is, however, difficult to define precisely. Economies of scale might be expected in high density areas in such services as sewer collection and treatment. A

TABLE 1

Coefficients of Simple Correlation, Per Capita Expenditure Categories

10 Provinces, 1962-1964

	Health	Sanitation	Social Welfare	Education	Trans-portation	Natural Resources	Debt Charges	General Government	Protection	Recreation	Other
Health.....	1.00										
Sanitation.....	0.23	1.00									
Social Welfare.....	0.22	-0.11	1.00								
Education.....	0.35	0.64	0.03	1.00							
Transportation.....	0.24	0.55	-0.19	0.55	1.00						
Natural Resources....	0.36	0.22	0.25	0.43	0.17	1.00					
Debt Charges.....	-0.50	-0.43	-0.34	-0.56	-0.26	-0.60	1.00				
General Government...	0.29	0.57	0.31	0.61	0.25	0.52	-0.25	1.00			
Protection.....	0.16	0.83	0.08	0.80	0.38	0.41	-0.54	0.64	1.00		
Recreation.....	0.42	0.79	-0.01	0.86	0.60	0.51	-0.70	0.57	0.82	1.00	
Other.....	-0.07	0.10	0.51	0.30	-0.25	0.28	-0.09	0.63	0.43	0.19	1.00

Source: Computed from data itemized in Appendix B.

high density may indicate a greater need for public rather than private provision of such services as recreation and cultural facilities. Expenditures may rise generally in high density areas because these areas experience higher factor input prices in the form of higher land costs, wage levels, and construction costs.

In dealing with provincial data one must select the best definition of population density. Large areas of many provinces are uninhabited so that a density variable which is the ratio of persons to total land area may lead to poor results in the regression analysis. In this study an attempt has been made to improve the variable; it is defined as the ratio of population to the number of square miles of privately owned land. Such a definition ignores the influence of large, uninhabited areas on government expenditures such as expenditure for general control, and expenditure for the protection of natural resources such as fire protection in forested areas. The density variable would perhaps have a greater validity if applied in a regression analysis involving expenditures of only urban governments.

That the influence of the two variables, density and population size, is ambiguous, is borne out by the simple correlation analysis. Density is negatively correlated with per capita expenditure on health, transportation, natural resources, and recreation. It is positively correlated with per capita expenditure on social welfare, education, sanitation, debt charges, general government, and protection. The positive correlation with sanitation expenditure seems to contradict our hypothesis that economies of scale occur in high density areas; however, this function is entirely a municipal one while the density variable is a measure of provincial density. The negative correlation with recreation

TABLE 2

Coefficients of Simple Correlation Between Expenditure Categories and Selected Independent Variables

10 Provinces, 1962-1964

	Health	Sanitation	Social Welfare	Education	Transportation	Natural Resources	Debt Charges	General Government	Protection	Recreation	Other	Total Expenditure
Population growth.....	-0.15	0.61	0.40	0.39	0.20	0.11	-0.42	0.39	0.74	0.45	0.38	0.44
Population density.....	-0.31	0.27	0.19	0.02	-0.07	-0.37	0.43	0.40	0.27	-0.11	0.48	0.11
Population size.....	-0.05	0.45	0.11	0.41	-0.44	-0.12	0.11	0.52	0.57	0.21	0.48	0.42
Personal disposable income per capita.....	0.35	0.89	-0.02	0.81	0.44	0.46	-0.51	0.72	0.91	0.87	0.33	0.88
Average weekly earnings.....	0.35	0.79	0.42	0.61	0.27	0.39	-0.55	0.72	0.87	0.70	0.46	0.77
Retail sales per capita.....	0.40	0.69	-0.10	0.85	0.53	0.45	-0.43	0.63	0.80	0.84	0.24	0.87
Motor vehicles per capita....	0.37	0.65	-0.26	0.85	0.62	0.50	-0.56	0.47	0.67	0.91	0.09	0.80
Value added per capita.....	-0.14	0.65	-0.01	0.39	0.13	-0.08	0.12	0.58	0.70	0.31	0.47	0.46

continued...

TABLE 2 (Concluded)

	Health	Sanitation	Social Welfare	Education	Trans-portation	Natural Resources	Debt Charges	General Government	Protection	Recreation	Other	Total Expenditure
Conditional grant.....	0.57		0.76	-0.03	0.03	0.73				-0.21		
Total conditional grants.....	0.01	-0.32	0.45	-0.44	0.07	-0.15	0.24	-0.14	-0.47	-0.42	-0.22	-0.28
Non-tax revenue excl. natural resources.....	0.55	0.64	0.11	0.82	0.46	0.59	-0.77	0.51	0.76	0.92	0.21	0.84
Natural resource revenue.....	0.22	0.40	0.24	0.64	0.40	0.40	-0.78	0.14	0.60	0.71	0.07	0.56
Total non-tax revenue.....	0.32	0.48	0.21	0.72	0.43	0.47	-0.82	0.24	0.67	0.79	0.11	0.66
Fiscal and tax-sharing arrangements.....	-0.15	-0.78	0.02	-0.70	-0.23	-0.39	0.51	-0.59	-0.94	-0.75	-0.47	-0.72
Federal subsidies.....	-0.20	-0.42	-0.29	-0.43	-0.06	-0.21	0.24	-0.49	-0.48	-0.38	-0.27	-0.46
Total federal unconditional grants.....	-0.19	-0.80	-0.07	-0.72	-0.24	-0.40	0.53	-0.64	-0.95	-0.76	-0.49	-0.75
Total tax revenue.....	0.38	0.77	0.03	0.75	0.31	0.37	-0.32	0.82	0.83	0.74	0.53	0.85
Total revenue.....	0.50	0.71	0.16	0.90	0.50	0.51	-0.66	0.65	0.84	0.93	0.35	0.94

Source: Computed from data itemized in Appendix B.

TABLE 3

Coefficients of Simple Correlation Between Selected Variables

10 Provinces, 1962-1964

	Population Growth	Population Density	Population Size	Personal Income	Weekly Earnings	Retail Sales	Motor Vehicles	Fiscal Arrangements	Federal Grants
Population growth	1.00								
Population density	0.44	1.00							
Population size	0.50	0.83	1.00						
Personal income per capita	0.50	0.17	0.49	1.00					
Average weekly earnings	0.78	0.36	0.54	0.82	1.00				
Retail sales per capita	0.33	-0.01	0.28	0.86	0.65	1.00			
Motor vehicles per capita	0.15	-0.28	0.04	0.79	0.44	0.87	1.00		
Fiscal and tax-sharing arrangements	-0.64	-0.27	-0.60	-0.87	-0.78	-0.70	-0.61	1.00	
Total federal unconditional grants	-0.68	-0.32	-0.63	-0.89	-0.84	-0.70	-0.60		1.00
Total tax revenue	0.40	0.38	0.65	0.92	0.78	0.79	0.66	-0.84	-0.86
Total revenue	0.47	-0.04	0.29	0.86	0.77	0.90	0.84	-0.73	-0.75

Source: Computed from data itemized in Appendix B.

expenditure is opposite to what was expected. As can be seen from Table 2, none of the coefficients of simple correlation exceeds 0.50 and only four exceed 0.35, the value of "r" at the .05 significance level. The direction of correlation between population size and the expenditure categories was identical with that of the density variable with the exception of recreation expenditure. The population size variable showed a correlation of 0.83 with population density.

The rate of population growth should have a significant positive effect on every category of expenditure. New facilities must be built in areas that are expanding, and this effect is further increased by the tendency, in slower growth areas, not to replace worn-out facilities. Actual expenditures may lag behind the population changes which cause them so that the effect may appear to be less significant than it really is. This variable is a derivative and thus must be interpreted with caution. For example, the same absolute increase in population of two provinces such as Ontario and Alberta would lead to vastly different rates of growth. A ten year simple growth rate was used in this study and was found to be positively correlated with every category of expenditure except debt charges. Nine of the simple coefficients of correlation exceed 0.35. Population growth is most strongly associated with sanitation expenditure at 0.61, and protection of persons and property at 0.74. The correlation analysis thus confirms our hypothesis.

Specific population characteristics such as age variables should be important determinants of expenditure as they reflect the demands of specific age groups. A population with a high percentage of young people would require greater expenditure on educational facilities than would a population with a large proportion of aged people, ceteris paribus.

Expenditures on social welfare programs might be expected to be high in the latter type of population, ceteris paribus. Specific age characteristics are not available for the years 1962, 1963, and 1964 and thus this hypothesis could not be tested accurately.

The receipt of conditional grants from the federal government has an impact on provincial and municipal government finance. Expenditures would be expected to increase for aided functions since many of these grants are cost-sharing arrangements between the provincial and federal governments. Expenditures for unaided functions may be encouraged as well because the conditional grants for one function may reduce the pressure of financial restraint under which the provincial and municipal governments operate and enable them to increase expenditure in other areas. There was significant correlation between grants to health, 0.57, and social welfare, 0.76, and expenditure in these categories. The reasons for this correlation are explored in later chapters.

The hypothesis that conditional grants encourage expenditure in other areas is not supported by the analysis. Correlation coefficients between the conditional grants for health, social welfare, transportation, and education and other expenditure categories are less than 0.35 and many show negative association. The correlation coefficients between total conditional grants and expenditure have signs opposite to that expected in nine of twelve expenditure categories. This hypothesis is thus not consistent with the results of the analysis.

Unconditional grants from the federal governments to the provinces which take the form of fiscal and tax-sharing arrangements, subsidies and federal payments in lieu of taxes might be expected to show a high positive correlation with all expenditures except debt

charges since the provincial government would be able to finance services with funds from outside sources. In fact there is a high negative correlation between the unconditional grants and expenditures. In every expenditure category, the sign is opposite to that expected with the negative correlation ranging from -0.07 for social welfare to -0.95 for protection expenditure. This simple hypothesis must therefore be rejected unless the result can be explained by other factors.

A closer examination of the nature of these federal payments in Canada and the reasons for the payments suggest an explanation which is consistent with the statistical results. The values of the variables describing federal government unconditional grants were determined under the Federal-Provincial Fiscal Arrangements Act passed in 1961 which applied to the tax years 1962 to 1966 inclusive. Under this Act, the federal government withdrew from the personal income tax field by 16 percent in 1962, 17 percent in 1963, and 18 percent in 1964, and withdrew from the corporation income tax field by 9 percentage points of corporate income. The federal government undertook to collect free of charge any income taxes levied by the provinces providing the tax base was identical with the federal base. From January 1, 1962 all provinces imposed their own personal and corporation income taxes. Ontario collected its own corporation income taxes and Quebec collected both its own corporation and personal tax. The income tax of the other provinces was collected by the federal government. The Act provided for the payment, by the federal government, of amounts collected under the provinces' income tax acts; of tax equalization payments, stabilization payments, Atlantic Provinces Adjustment Grants, Additional Grant to Newfoundland, estate duty payments, power utility tax payments and statutory subsidies.

Equalization grants were based on the national average per capita yield from income tax, estate tax, and resource revenue. The standard taxes for the 1963-64 fiscal year were: personal income tax, 17 percent, corporation income tax, 9 percent, inheritance tax, 50 percent.[5]

The federal government also undertook to make stabilization grants to ensure that their yield from standard taxes plus equalization would not in any year fall below 95 percent of the average for tax rental, equalization, and stabilization for the two preceeding years.

The Atlantic Provinces receive special grants and Newfoundland receives a grant in addition to its share of the Atlantic Provinces special grants. Statutory subsidies which include allowances for government, for population, interest on debt allowances, and special grants are paid to all provinces. The Atlantic provinces receive a greater per capita amount of these subsidies than do the other provinces.

Thus, because of the structure of the fiscal and tax-sharing arrangements, high values for these variables for the poor provinces and low values for the wealthy provinces would be expected. Since the income tax yield to the provinces is quite the reverse, we would expect a high negative correlation between tax collections and the fiscal and tax-sharing arrangements variable. The actual correlation between total provincial-municipal tax collections and this variable is -0.84.

Equalization and stabilization grants were made to the poorer provinces because of the fiscal arrangements formulas and special grants

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[5]For a description of how these standard taxes are determined see Canadian Tax Foundation, National Finances, 1964-65, (Toronto: Canadian Tax Foundation, 1965), p. 121.

were made to these provinces to enable them to provide a higher level of services. For example, the special grant to Newfoundland was recommended in 1957 by the McNair Commission to help Newfoundland to maintain its public services at the level prevailing in the other Atlantic provinces. If this hypothesis is correct, one would expect to find negative correlation between the total federal unconditional grants and variables such as personal disposable income per capita, average weekly earnings, retail sales per capita, and motor vehicles per capita. The coefficients of simple correlation were calculated to be -0.89, -0.84, -0.70, and -0.60 respectively.

Our original hypothesis, that the receipt of outside funds in the form of federal government grants encourages provincial and municipal government expenditures, can be supported by the analysis. The observed negative correlation between this variable and expenditures can be explained by factors outlined above.

The non-tax revenue variable is the sum of revenues from liquor control permits, motor vehicle licences, natural resource privileges, sales and services, fines and penalties, contributions from government enterprises, and other, unclassified revenues. The greater the amount of revenue from non-tax sources, the higher the level of spending by government is expected. A province which enjoys a high level of non-tax revenue in relation to another province, ceteris paribus, could provide more government services than the other province without resorting to an increase in direct taxes, to which there might be public resistance. For example, the province of Alberta is able to provide a wide range of government services without having imposed a sales tax because of revenues it receives from natural resources.

The sign of the correlation coefficient between non-tax revenues and each of the twelve functional categories is as expected, namely, positive in all cases except for debt charges. The degree of association is strongest for education, recreation, debt charges, protection, and total expenditure with coefficients of 0.72, 0.79, -0.82, 0.67, and 0.66, respectively. The correlation with social welfare is small, 0.21. Natural resource revenue shows a similar degree of association with the correlation being slightly less in each case. A non-tax revenue variable which excludes revenue from natural resources shows a similar ranking with the correlation coefficient greater in most cases than the total non-tax variable; for example, the correlation between the modified variable and total expenditure is 0.84. The correlation between the modified non-tax revenue variable and natural resource revenue is 0.78. The total non-tax revenue variable is used in the multiple regression analysis since it is more inclusive of the factors hypothesized to affect expenditures.

The level of personal income affects the type of demands for government services. Higher income areas are likely to demand higher quality educational facilities and more recreation and cultural services. High income areas might be expected to demand less expenditure on social welfare programs and on public medical care. The correlation coefficients calculated are consistent with the above hypotheses with the exception of health expenditure. The coefficients between personal income and health, welfare, education, recreation, and total expenditure are 0.35, -0.02, 0.81, 0.87, and 0.88 respectively.

Personal disposable income per capita is, as expected, highly related to retail sales per capita, average weekly earnings, and motor

vehicles per capita with coefficients of 0.86, 0.82, and 0.79 respectively. Income is strongly associated with total taxation revenue at 0.92, and with total revenue at 0.86. It is moderately associated with total non-tax revenue at 0.55.

Per capita value-added by manufacturing establishments is used as a measure of the extent of industrial activity in a province. This variable shows significant positive correlation with respect to sanitation, education, general government, protection, other, and total expenditure. It is associated with personal disposable income per capita at 0.62. The reasons for the correlation between the value-added variable and expenditure categories are examined in subsequent chapters.

Total revenue of the provincial and municipal governments is, of course, closely related to total expenditures of these governments. The correlation coefficient between these two variables is 0.94. The degree of correlation between total revenue and the functional categories of expenditure varies considerably, however, from 0.16 for social welfare to 0.93 for recreation. Thus while total expenditures are restricted by a budget constraint, the distribution of funds between the various functions of government is determined, at least in part, by factors other than the level of government revenues. The variables which explain the variation in expenditure among governments might also be expected to explain some of the variation in government revenues.

The simple correlation analysis was used as a guide in the selection of independent variables thought to be major determinants of provincial and municipal government expenditure in the years 1962 to 1964. Individual functions were more closely examined with the aid of multiple

regression techniques. Several combinations of variables were tested for each function and the most significant of these regressions are presented in the following chapters.

CHAPTER II

EXPENDITURE ON MAJOR FUNCTIONS

This chapter examines provincial and municipal government expenditure on education, health, social welfare and transportation. The variation in per capita expenditure for these major functions is briefly discussed and the results of the multiple regression analysis involving these expenditure categories are presented.

The independent variables which have been chosen to enter the regression equations were chosen in the following manner. First of all, variables which were considered a priori to be determinants of expenditure were subjected to a simple correlation analysis, the results of which are reported in Chapter I and Appendix D. An average of thirteen multiple regressions were run for each function using various combinations of variables. Only the most significant equations for each function are presented in this chapter. Some variables had to be dropped because of the multicollinearity problems, others were dropped because they explained little or none of the variation in the dependent variable. In some instances variables which added little explanation are presented in this chapter in order to illustrate the results of tests of specific hypotheses.

Expenditure on Education

The provision of educational services in Canada is primarily the responsibility of the provincial and municipal governments. The

federal government provides education for Indian and Eskimo children and provides grants to the provincial governments for vocational training and university education. These latter contributions have little influence on the provision of educational services by the provincial and municipal governments as indicated by the low correlation, -0.03, between federal conditional grants for education and expenditure.[1]

Table 4 indicates the differences in per capita expenditures among the provinces in 1962 to 1964. The average expenditure for the three years was lowest in Newfoundland at $58.75 per capita, well below the national average of $97.06 per capita. Highest per capita expenditure occurred in Alberta at $129.63, more than double the Newfoundland expenditure. Expenditures in the four Maritime provinces were below the national average while expenditure on education in the other six provinces was above the average.

Although education is a provincial and municipal function, the proportion of services provided by the two levels of government varies considerably from province to province. In Newfoundland, municipal governments contributed only 1.7 per cent of the total expenditure on educational services in 1964.[2] In other provinces, the municipal governments contributed from 42.3 per cent in Alberta to 57.1 per cent in New Brunswick. The national average of municipal participation was 43.0 per cent.

The wide variation in expenditure among the provinces may be explained by many factors. Some of these factors such as religious,

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[1]See Table 2.

[2]See Table 4.

TABLE 4

Per Capita Expenditure on Education by Province

1962-1964

Province	Per Capita Expenditure Average 1962-64	Per Cent Municipal 1964
Newfoundland	$ 58.75	1.7
Prince Edward Island	93.14	50.1
Nova Scotia	77.47	43.1
New Brunswick	72.84	57.1
Quebec	101.43	37.2
Ontario	116.93	48.8
Manitoba	93.44	51.7
Saskatchewan	118.18	50.8
Alberta	129.63	42.3
British Columbia	108.75	47.0
Mean	97.06	43.0
Standard Deviation (n = 30)	22.40	

Source: Computed from data in Dominion Bureau of Statistics, Consolidated Government Finance, 68-202, 1962 to 1964, (Ottawa: Queen's Printer, 1962, 1963, 1964), Table 7.

social, and cultural ones are not easily quantifiable. For example, the low expenditure in Newfoundland can be partially accounted for by the structure of the school system which is operated, for the most part, by religious organizations. Such factors are discussed by province in literary fashion below. Other determinants of expenditure such as the level of personal income, the extent of industrial activity and the level of non-tax revenue are more readily quantifiable and are examined statistically in the latter part of this section.

As has been noted, the schools of Newfoundland depend more on provincial government aid than the schools of any other province. In the fiscal year 1963, for example, local government expenditures for elementary and secondary education amounted to approximately $325,000 while the provincial government expenditure was about $20.4 million.[3] Local school boards charge fees ranging from $0.50 to $10.00 a month per child. School boards may also raise money by voluntary subscription. A School Tax Authority may be established under the Education Act with powers to raise money by property and poll taxes. The province makes grants to the local school boards according to specified scales for teachers' salaries; maintenance, equipment and supply; libraries; and the cost of school land and buildings.

Newfoundland is divided into 267 education districts. Most of the schools are denominational and in order of the number of school districts controlled, the denominations are Church of England, United Church, Roman Catholic, Salvation Army, Presbyterian, Seventh Day

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[3]Canadian Tax Foundation, Provincial Finances 1967, (Toronto: Canadian Tax Foundation, 1967), p.104.

Adventists and Pentecostal. There were 39 amalgamated school districts in 1967.[4]

The Prince Edward Island provincial government provides grants to local school boards towards the salaries of teachers, the cost of elementary and high school operation, maintenance and capital requirements. The municipal share is raised by a poll tax on residents over 21 years of age and from a levy on real property. The Board of Trustees in each of the 389 school districts has the right to assess property and collect taxes.

All local revenues for education in Nova Scotia are raised by levies on real and personal property which are collected by the municipal governments. The provincial government provides a grant determined by the value of real and personal property subject to taxation in the school district.

Education was financed in New Brunswick in 1962 to 1964 by provincial grants, a local poll tax ranging from $1.00 to $10.00, and local real and personal property taxes.

The educational system is in a state of flux in Quebec and no clear picture of finance is available for the three years covered in this study. The expenditure for the province of Quebec for education used in the regression analysis are Dominion Bureau of Statistics estimates. Because Quebec may be considered a province different from the others, culturally and politically, it would perhaps have been desirable to drop this observation from the sample. However, the sample consists of only 10 provinces and it was not statistically desirable to use a smaller sample.

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[4] Ibid., p.103

Education is financed by provincial grants and levies on property in Ontario, Manitoba, Saskatchewan, Alberta and British Columbia. Differences in expenditure in these provinces may not result so much from differences in the school structure or local methods of financing education but from differences in the attitude of the provincial administrations regarding the priority of education.

The level of personal income prevailing in a province and the extent of industrial activity in a province have an effect on both the demand for educational facilities and, indirectly, on the supply of tax funds for education. High income groups might be expected to demand more expenditure on education than low income groups. An industrial society has a greater need for trained personnel than does a rural community. Areas of high income and industrial activity may have a larger tax base from which to draw funds for educational purposes. For example, provincial income taxes will be high in such areas and municipal governments may be able to collect more property taxes. Since education in most provinces is financed through property taxes and provincial grants to local schools, such an area could demand and obtain greater expenditure on education than could a poorer and less developed region.

For the reasons noted in Chapter II non-tax revenue is expected to have a positive influence on education expenditure.

The quality of educational services is expected to have an influence on the cost of providing these services; higher quality services might be expected to cost more. The variable chosen in this study to represent the quality of education is the pupil/teacher ratio in elementary and secondary schools. It is assumed that a lower pupil/teacher ratio indicates a higher quality of education and one would expect to find a

negative correlation between this variable and per capita education expenditure. The coefficient of simple correlation, as can be seen from Table 5, was computed to be -0.47.

The concept of merit wants as a determinant of education expenditure is considered in this study. The variable chosen to represent the demand for this type of public good is the pupil/teacher ratio in private schools. The mechanism through which private expenditure on education influences public expenditure may be thought of in the following manner. If the pupil/teacher ratio in private schools is low, then one could assume that the quality of education in private schools is higher than in schools with a higher ratio. When citizens who are sending their children to publicly controlled schools become aware of the higher quality education, they may demand a higher quality in the public schools. Provincial and municipal government education expenditures would thus be higher in provinces with a low private school pupil/teacher ratio suggesting a negative correlation between the two variables. The correlation is 0.23, indicating that the data do not support the hypthesis of merit wants as applied to education expenditure.

The influence of personal disposable income per capita, value added per capita, non-tax revenue per capita, pupil/teacher ratio in public schools and the pupil/teacher ratio in private schools was further tested by multiple regression techniques. These results are presented below. The designation of the variables in the regression equations is given in Table 5 and Appendix C. The equations are

TABLE 5

Coefficients of Simple Correlation

Education Expenditure and Selected Variables *

10 Provinces, 1962-1964

	Y_6	X_1	X_2	X_4	X_7
Education expenditures, Y_6	1.00				
Personal disposable income per capita, X_1	0.81	1.00			
Non-tax revenue per capita, X_2 ..	0.72	0.56	1.00		
Value added per capita, X_4	0.39	0.62	0.00	1.00	
Pupil/teacher ratio, private schools, X_7	0.22	0.28	0.22	-0.10	1.00
Pupil/teacher ratio, public schools, X_8	-0.47	-0.24	-0.40	0.13	-0.05

* Untransformed data

Source: Appendix D, Tables 1 and 2.

$$Y_{t6}: = 100.91 + \underset{(2.50)}{0.035X_1} + \underset{(2.53)}{0.16X_2} + \underset{(0.80)}{0.0097X_4} + \underset{(0.23)}{0.14X_7} - \underset{(-2.19)}{2.73X_8} - \underset{(-0.39)}{1.97D_2} + \underset{(0.31)}{1.61D_3} \quad (1)$$

$$\bar{R}^2 = 0.75$$

$$\log Y_6 = 6.27 + \underset{(3.54)}{0.80\log X_1} + \underset{(0.74)}{0.05\log X_2} - \underset{(0.84)}{0.04\log X_4} + \underset{(0.41)}{0.51\log X_7} - \underset{(-1.98)}{0.73\log X_8} - \underset{(-0.34)}{0.20\log D_2} + \underset{(0.23)}{0.14\log D_3} \quad (2)$$

$$\bar{R}^2 = 0.72$$

The signs of the regression coefficients of personal income, non-tax revenue, and the pupil/teacher ratio in public schools are as predicted. The sign of the value added coefficient changes in the two models and the coefficient is not significant at the 0.05 level.[5] The regression coefficient for non-tax revenue is not significant at the 0.05 level in the double logarithmic model. The variable measuring private expenditure on education, X_7, is not significant and has a sign opposite to that predicted in both equations.

The observed negative coefficient for value added and the poor estimate of the non-tax revenue coefficient may be caused by multicollinearity since some of the independent variables, as can be seen from Table 5 and Appendix D, Table 4, are statistically interrelated. Value added is correlated with personal income at 0.62 for both the untransformed and transformed data. The simple correlation between non-tax revenue and personal income in the untransformed data is 0.56 but the

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[5]The critical t value for 23 degrees of freedom at the 5 per per cent significance level is 2.07.

correlation rises to 0.72 when logarithms of the variables are taken.

To further test the significance of non-tax revenue and value added in explaining education expenditure, regressions were run using only these two variables as explanatory variables. The equations are estimated to be:

$$Y_6 = 61.83 + 0.33X_2 + 0.0030X_4 - 0.09D_2 + 2.71D_3 \qquad (3)$$

t: (6.09) (3.35) (-0.02) (0.43)

$\bar{R}^2 = 0.63$

$$\log Y_6 = 3.42 + 0.30\log X_2 + 0.07\log X_4 + 0.00\log D_2 + 0.02\log D_3 \qquad (4)$$

t: (5.28) (1.57) (0.01) (0.28)

$\bar{R}^2 = 0.55$

These equations show the influence of non-tax revenue to be significantly different from zero and the influence of value added to be positive.

In the additive model, that is, the first model, the dummy variables affect the value of the intercept. Since government expenditures generally rose during the period one would expect the dummy variables to have a positive sign. None of the coefficients, however, are significantly different from zero. This suggests that, although government expenditures rose during the period 1962 to 1964, they did not rise a sufficient amount to change the intercept of the regression equations.

The regression coefficients of the explanatory variables in the double logarithmic model can be directly interpreted as elasticities. The coefficient of all the explanatory variables for this function of government are inelastic; for example, a 10 per cent rise in personal income per capita is associated with an 8 per cent rise in per capita expenditure on education while a 10 per cent increase in the pupil/teacher ratio in public schools is associated with a 7 per cent decrease

in expenditure.

The results of the multiple regression analysis show that the influence of all the explanatory variables except X_7 is consistent with the hypotheses that have been proposed.

Expenditure on Health and Hospitalization

Government expenditures on hospitals and public health programs are considerably less than expenditures for education. The average provincial and municipal expenditure on health amounted to $42.11 per capita in 1962 to 1964 while the average expenditure for education during that period was $97.06 per capita.

Table 6 indicates the average per capita expenditure on health by province for the years 1962 to 1964. Total health expenditure per capita varied from a low of $29.77 in Prince Edward Island to a high of $71.09 in Saskatchewan. The national average was $42.11. Expenditure on hospitals varied from $24.63 to $44.76 with a national average of $34.38 per capita. Prince Edward Island was lowest and Saskatchewan highest for this type of expenditure. Per capita expenditure for other health programs varied from $4.10 in Nova Scotia to $26.33 in Saskatchewan. The standard deviation for other health expenditure was $7.05 and the mean was $7.74. The variation in expenditure was much greater than in the case of hospital expenditure where the mean was $34.38 with a standard deviation of $6.92. The high standard deviation of other health expenditures is caused largely by the influence of the Saskatchewan observation which is more than three times as great as the next highest per capita expenditure.

Table 6 also indicates the municipal government share of health expenditures in 1964. There are striking differences in municipal participation both among the provinces and between hospital and other health expenditure within a province. The municipal share of total expenditure on health varies from zero in Newfoundland and Prince Edward Island to 20.2 per cent in Alberta. In New Brunswick, Quebec and British

TABLE 6

Per Capita Expenditure on Health

1962-1964

Province	Hospital Care		Other Health		Total Health	
	Average Expenditure 1962-64	Per Cent Municipal 1964	Average Expenditure 1962-64	Per Cent Municipal 1964	Average Expenditure 1962-64	Per Cent Municipal 1964
Newfoundland.....	$ 38.56	0.0	$ 6.41	0.2	$ 44.97	0.0
Prince Edward Island..	24.63	0.0	5.14	0.0	29.77	0.0
Nova Scotia.....	30.85	7.6	4.10	12.4	34.95	8.2
New Brunswick.....	33.14	1.6	4.93	27.3	38.08	5.5
Quebec.....	30.84	0.0	5.20	25.9	36.03	2.8
Ontario.....	38.66	4.5	4.26	36.2	42.93	7.9
Manitoba.....	34.88	2.1	6.49	23.9	41.37	6.2
Saskatchewan.....	44.76	8.3	26.33	3.1	71.09	6.2
Alberta.....	36.10	19.4	6.69	24.3	42.78	20.2
British Columbia.....	31.37	2.8	7.82	12.8	39.19	4.7
Mean.....	34.38	4.6	7.74	16.6	42.11	6.2
Standard Deviation.... (n = 30)	6.92		7.05		12.02	

Source: Computed from data in Consolidated Government Finance, 1962 to 1964, Table 7.

Columbia the municipal share is lower than the national average of 6.2 per cent. The municipal share of hospitalization is zero in Newfoundland, Prince Edward Island and Quebec and 19.4 per cent in Alberta. Municipal Governments in Quebec contribute nearly 26 per cent of other health expenditure, compared to 3.1 per cent in Saskatchewan.

As in the case of education some of the variation in expenditure and in the percentage involvement of municipal governments can be explained by factors such as differences in the type of services provided, the political attitude of government administrations, and differences in the methods of financing health expenditures. These factors are discussed below. Other determinants of health expenditure such as personal income, federal government unconditional grants, private expenditure on health and other quantifiable factors are subjected to a statistical treatment in the latter part of this section.

Public health services provided by the various provincial governments are quite similar for most types of health programs. Included in the other health expenditure variable are expenditures for mental health, public health nursing, industrial hygiene, epidemiology, tuberculosis control, cancer treatment, maternal and health care, and control of the safe production of milk. One would not expect much variation in expenditure for these types of programs among the provinces and, with the exception of Saskatchewan, this appears to be the case. The large expenditure in Saskatchewan relative to the other provinces is due mainly to the provision of medical care services. A medical care plan was introduced on July 1, 1962 to provide universal coverage for the residents of the province on a prepaid basis. Saskatchewan was the only province which had this type of plan during the period covered by this study. The

plan was financed as follows: (a) 12 per cent of the estimated costs from personal premiums; (b) 61 per cent from 30 per cent of a 4 per cent sales tax; (c) 27 per cent from income and corporation tax revenue which constituted about 1 per cent of taxable income.[6]

All provinces participate in a hospital plan insurance scheme which covers almost 99 per cent of the population. All provinces except Newfoundland provide out-patient services on an emergency basis. British Columbia and Alberta charge co-insurance or deterrent fees. Saskatchewan was the first province to institute government-financed hospital care in 1944 and Quebec was the last in 1961. This may explain part of the difference in per capita expenditure for hospital care, which was $44.76 in Saskatchewan in 1962-1964 as compared to $30.84 for Quebec. Saskatchewan was governed by the Cooperative Commonwealth Federation Party for 20 years until 1964. This party had the explicit aim of encouraging government provision of health services and this political factor accounts for a portion of the difference in expenditure among the provinces.

The provinces financed their share of the hospitalization plans in many different ways. Newfoundland, Prince Edward Island, New Brunswick and Quebec finance their plans entirely from general revenue. Alberta raises a part of its hospital cost through a property tax levied on equalized assessments. The municipal governments collect this tax on behalf of the provincial government. This explains the high municipal percentage contribution to health expenditure in Alberta as compared to other provinces.[7] Ontario, Saskatchewan and Manitoba use a combination of personal premiums supplemented by general revenues to finance their

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[6] Provincial Finances, 1967, p. 138.

[7] See Table 6.

hospital plans. Saskatchewan earmarks part of its sales tax for hospitalization while Nova Scotia finances the total cost from a sales tax. These various methods of financing hospital costs might be expected to have some influence on the quality and extent, and thus costs of health services.

Economic variables expected to influence health expenditure are personal disposable income per capita, the level of non-tax revenue, population density, private expenditure on health, and federal government conditional grants to the provinces for health. The correlation between these factors and health expenditure is given in Table 7. The multiple regression equations are estimated to be:

$$Y_3 = -78.62 + 0.028X_1 - 0.0034X_2 - 0.028X_6 + 5.06X_{10} - 2.07X_{11} -$$
$$\text{t:} \qquad (1.84) \quad (-0.06) \quad (-0.53) \quad (3.26) \quad (-1.85)$$
$$11.07D_2 - 10.69D_3 \qquad (5)$$
$$(-1.92) \quad (-1.48)$$
$$\bar{R}^2 = 0.43$$

$$\log Y_3 = -2.29 + 0.75\log X_1 + 0.05\log X_2 - 0.03\log X_6 + 2.30\log X_{10} -$$
$$\text{t:} \qquad (2.12) \quad (0.47) \quad (-0.61) \quad (3.09)$$
$$0.55\log X_{11} - 0.23\log D_2 - 0.21\log D_3 \qquad (6)$$
$$(-2.60) \quad (-1.98) \quad (-1.45)$$
$$\bar{R}^2 = 0.53$$

Personal income is expected to show a negative association with health expenditure on the assumption that a high income area would demand less expenditure on public health than low income areas since higher income persons are better able to provide for their own medical care. The regression coefficient in both cases is positive which would suggest that such an assumption as applied to this data is not valid. An

TABLE 7

Coefficients of Simple Correlation

Per Capita Health Expenditure

and Selected Independent Variables

10 Provinces, 1962 - 1964

	Y_3	X_1	X_2	X_6	X_{10}
Total health expenditure, Y_3.....	1.00				
Personal disposable income, X_1....	0.35	1.00			
Total non-tax revenue, X_2.....	0.32	0.56	1.00		
Population density, X_6.....-0.31		0.17	-0.35	1.00	
Federal health grant, X_{10}.....	0.57	0.40	0.30	-0.12	1.00
Private health expenditure, X_{11}...	0.21	0.91	0.45	0.30	0.44

Source: Appendix D.

alternative theory is put forward below which may explain this result.

The theory of merit wants is tested for this function. The mechanism is assumed to operate in a parallel fashion to that outlined for educational expenditure. For example, in areas with high private expenditures for health, one might expect public demands for equivalent health and hospital services. A positive correlation between private expenditure and public expenditure is expected. The simple correlation coefficient is computed to be 0.22. The sign of the regression coefficient of X_{11} is, however, negative in both models. Accurate data on private health expenditure are not available for the years 1962 to 1964. A variable was constructed by dividing the total income of all medical doctors in a province by the population of the province. This is perhaps a poor measure of private expenditure and could be one cause of the unexpected result. Variable X_{11} is highly associated with personal income, variable X_1; the simple correlation is 0.91. The two hypotheses regarding the influence of X_1 and X_{11} do not seem to be consistent with one another. High income areas are assumed to spend more on private health than low income areas. This is confirmed by the analysis. The hypothesis of merit wants then implies that high income areas demand more public health services. The original hypothesis regarding income was that high income areas have less need for public health services. However, an alternative hypothesis consistent with the results is that high income areas demand higher quality health services, both private and public.

Population density is expected to have a negative regression coefficient since economies of scale might arise in providing health services in areas where the population is less dispersed. The regression

analysis appears to support this hypothesis although the coefficient is not significant at the .05 level.

The sign of the non-tax revenue variable in the first equation is opposite to that expected. A regression was run using X_2 as the only explanatory variable. The equation is estimated to be:

$$\begin{aligned} X_3 &= 34.48 + 0.075X_2 + 1.64D_2 + 6.20D_3 \\ t: &\qquad\qquad (1.62) \quad (0.31) \quad (1.18) \\ \bar{R}^2 &= 0.09 \end{aligned} \tag{7}$$

This equation exhibits the expected regression coefficient but the equation is not significant at the .01 significance level.

The federal government grants to the provinces for health appear to be strongly related to government expenditure. The coefficients in both models are positive and significant at the .05 level. The elasticity coefficient is 2.30 indicating that a 10 per cent change in the federal grants would be associated with a 23 per cent change in provincial and municipal health expenditure.

This result is to be expected when the nature of the federal grants is examined. Under the federal Hospital Insurance and Diagnostic Services Act of 1957, the federal government contributes an aggregate grant composed of 25 per cent of the per capita costs of specified in-patient services in Canada; and 25 per cent of the per capita costs of the specified in-patient services in each province, less the per capita amount of deterrent charges, multiplied by number of persons eligible and entitled to insurance services. The federal government shares the same proportion of out-patient services in each province. This formula results in the high-cost provinces receiving a lower percentage of their total expenditure from the federal government than the low-cost provinces.

The federal grants average out to about 50 per cent of the eligible hospital costs across Canada.[8] Since hospital costs made up the major part of health services in 1962 to 1964, this variable could be expected to have a strong positive influence on total health expenditure. The influence of this variable is further tested by regressing hospital care expenditures against federal grants. The equations are:

$$Y_1 = -24.46 + 2.75X_{10} - 8.46D_2 - 7.04D_3 \qquad (8)$$

t: (3.41) (-2.49) (-1.70)

$\bar{R}^2 = 0.33$

$$\log Y_1 = -2.68 + 2.03\log X_{10} - 0.28\log D_2 - 0.25\log D_3 \qquad (9)$$

t: (3.87) (-2.91) (-2.18)

$\bar{R}^2 = 0.37$

These results are consistent with the results of the previous equations relating health expenditure and the federal grants.

Although the regression analysis indicates that federal grants are associated with health expenditure, the analysis does not indicate the direction of causation. In most cases changes in the explanatory variable are assumed to be the cause of changes in the dependent variable. It may be argued that since the grants are paid after the hospital costs have occurred, the direction of causation is from expenditure to grants. It may also be argued, however, that provincial officials, realizing that nearly 50 per cent of the costs will be paid for by the federal government, are encouraged to spend additional funds. This was certainly true when the federal act was passed, since it was the catalyst which caused the provinces to set up hospital insurance plans.

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[8] Provincial Finances, 1967, p. 140.

The direction of causation may not be so clear when all provinces are participating as they were for the years covered in this study. The grants do appear, however, to be the strongest factor associated with health expenditure of all those considered.

Expenditure on Social Welfare

The responsibility for providing social welfare services is shared among the federal, provincial and municipal governments. Some welfare programs are provided by a single level of government while other programs are carried out on a cooperative basis between two, and sometimes the three, levels of government.

Per capita expenditure on social welfare by the provincial and municipal governments from 1962 to 1964 is shown in Table 8. Expenditure varied from $13.75 per capita in Ontario to $26.32 in Newfoundland. Expenditure in Quebec was almost double the expenditure in the province of Ontario. Prince Edward Island, Nova Scotia, New Brunswick and Manitoba had expenditures less than the national average of $18.76 per capita.

There are striking differences among the provinces in the extent of municipal government participation in welfare schemes. Municipal authorities in Newfoundland provided no social assistance while the municipal share in Ontario was 30.1 per cent in 1964.

The federal and provincial governments participate in several shared-cost programs. The main federal-provincial programs are old age assistance, unemployment assistance, allowances for the blind and disabled, and rehabilitation services. The first two programs are distinct from old age security and unemployment insurance benefits, which are federal programs.

Under the Old Age Assistance Act, the federal government contributed 50 per cent of assistance payments of not more than $65.00 and $75.00 per month to persons of 65 years of age or older who were not eligible for Old Age Security payments. British Columbia, Quebec, Alberta and Ontario paid supplements on a needs basis. The federal

TABLE 8

Per Capita Expenditure on Social Welfare

10 Provinces, 1962-1964

Province	Per Capita Expenditure Average 1962-64	Per Cent Municipal 1964
Newfoundland	$ 26.32	0.0
Prince Edward Island	15.11	2.3
Nova Scotia	14.01	17.3
New Brunswick	14.50	15.8
Quebec	26.22	4.3
Ontario	13.75	30.1
Manitoba	15.74	12.9
Saskatchewan	19.85	6.0
Alberta	20.78	2.7
British Columbia	21.45	14.7
Mean	18.76	10.6
Standard Deviation (n = 30)	4.88	

Source: Computed from data in Consolidated Government Finance, 1962 to 1964, Table 7.

government shared the cost of this additional assistance with the provinces through the federal unemployment assistance program.

The federal government shares on a matching basis, assistance payments made by the provincial and municipal governments to persons unemployed and in need. Under the Unemployment Assistance Act, the federal share of assistance is based on the number of unemployed persons in a province and the average monthly cost of assistance per person. Recipients of benefits under the Unemployment Insurance Act, Old Age Security Act, Old Age Assistance Act, Blind Persons Act, or Disabled Persons Act and recipients of mothers' allowances are not defined as unemployed under this act. Certain exclusions from eligible costs are made in order to treat all provinces on an equal a basis as possible.[9] The rates of assistance and the conditions of payment are determined by the provincial governments.

The federal government contributes 75 per cent of allowances paid to blind persons who fulfil certain residence and means test requirements. Quebec, Ontario, Saskatchewan and Alberta pay supplements on a needs test basis.[10] The cost of these supplementary benefits is shared 50 per cent with the federal government.

The federal government shares, on a 50 - 50 basis, provincial allowances paid by the provinces to totally disabled persons who fulfil residence and means test requirements; the costs of provincial programs for the rehabilitation of disabled persons; and supplements paid by

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[9]See Provincial Finances, 1965, Chapter 9, for a more detailed description of these programs.

[10]A "needs" test takes into account basic living requirements and financial resources. A "means" test is a maximum income test.

British Columbia, Ontario and Quebec.

Provincial and municipal programs, the costs of which are not shared by the federal government, consist of programs such as mothers' allowances, child protection and child care services, and homes for the aged. There are differences among the provinces in the number and extent of such programs, as well as in the division of responsibility between the two levels of government. These differences could account for some of the variation among provinces in social welfare expenditure observed for 1962 to 1964.

In most provinces, services to neglected children are provided in whole or part by non-governmental organizations. The Newfoundland government, however, finances most of such care in the province. Newfoundland is the only province in which the municipal governments bear no part of the cost of public assistance.

Public expenditure for homes for the aged differ from province to province. For example, such homes are operated by the government in Prince Edward Island while in New Brunswick most of the homes for the aged are privately operated. In Nova Scotia homes are operated by municipal governments, voluntary organizations and private corporations, and in Quebec they are financed by charitable institutions and private corporations. The three prairie provinces all provide some type of government assistance for such homes, but in British Columbia most homes are privately operated.

The provinces have different residence requirements and varying means and needs tests qualifications for general assistance. These differences can be expected to account for some of the variation in welfare expenditures among the provinces.

Expenditures on the various types of welfare assistance were correlated and the results are shown in Table 9. There appears to be no association between the programs for 1962 to 1964.

Welfare expenditure was correlated with several economic variables and appears to be significantly associated with federal conditional grants to the provinces for welfare, and population growth. The simple correlation coefficients are 0.76 and 0.40.[11] In Chapter I it was suggested that the level of personal income would have a negative influence on welfare expenditure; the correlation is -0.02. The following multiple regression equations show the effect of these three variables on expenditure for 1962 to 1964. The variables are designated as follows: Y_5 is per capita welfare expenditure; X_1 is personal disposable income per capita; X_9 is the federal conditional welfare grants per capita; and X_{13} is the rate of population growth. The equations are:

$$Y_5 = 1.34 + 0.00073X_1 + 1.30X_9 + 0.16X_{13} - 0.26D_2 + 0.16D_3 \quad (10)$$

t: (0.32) (5.91) (2.63) (-0.19) (0.12)

$\bar{R}^2 = 0.66$

$$\log Y_5 = 0.73 + 0.18\log X_1 + 0.75\log X_9 + 0.15\log X_{13} - 0.03\log D_2 - 0.01\log D_3 \quad (11)$$

t: (1.16) (6.49) (2.69) (-0.48) (-0.12)

$\bar{R}^2 = 0.67$

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[11] See Table 2

TABLE 9

Coefficients of Simple Correlation

Between Types of Social Welfare Expenditure

by Province, 1962-1964

	Aid to Unemployed	Aid to Blind & Disabled	Old Age Assist-ance	Other Aid to the Aged
Aid to unemployed.....	1.00			
Aid to blind and disabled....	-0.10	1.00		
Old age assistance.....	0.22	0.23	1.00	
Other aid to the aged.....	-0.24	-0.36	-0.22	1.00
Other.....	0.27	-0.05	-0.03	-0.12

Source: Computed from data itemized in Appendix B.

The federal conditional welfare grants appear to be significantly related to welfare expenditure. It should be recalled that the federal share of welfare costs has been eliminated from the provincial-municipal expenditures so that the analysis cannot be criticized on the grounds that the same variable appears on both sides of the equation. The influence of this variable was further tested by regressing welfare expenditure against only the grants variable. The results were:

$$Y_5 = 5.95 + 1.31X_9 - 0.37D_2 - 0.04D_3 \qquad (12)$$

t: (5.71) (-0.25) (-0.02)

$\bar{R}^2 = 0.52$

$$\log Y_5 = 1.34 + 0.69\log X_9 - 0.03\log D_2 + 0.01\log D_3 \qquad (13)$$

t: (5.48) (-0.34) (0.07)

$\bar{R}^2 = 0.51$

These results are consistent with the previous results and show that slightly more than 50 per cent of the variation in welfare expenditure can be explained by the grants variable alone.

The signs of the income and population growth variable are positive. This appears to contradict the hypothesis that high income areas demand less government spending on welfare, while confirming the hypothesis that fast growing areas experience higher government expenditure.

Expenditure on Transportation and Communication

Transportation is one of the major functions of the provincial and municipal governments, ranking second after education expenditure. The average per capita transportation expenditure for all provinces from 1962 to 1964 was $62.21. This compares to the average expenditure on education of $97.06, on health of $42.11 and on social welfare of $18.76.

The variation in transportation expenditure among the provinces is shown in Table 10. Although Saskatchewan had almost four times the road mileage of British Columbia, and more than twice that of Quebec in 1964, expenditure in Saskatchewan was $65.12 per capita compared to $70.44 in British Columbia and $44.92 in Quebec. Less than 10 per cent of all roads in the prairie provinces were paved, and over 60 per cent of roads in Saskatchewan were earth roads in 1964. Over 20 per cent of roads in all other provinces except Newfoundland were paved.[12] These data indicate that the cost and rate of road construction in various provinces might be partly determined by geography and by the type and location of economic activity, for example, Saskatchewan's economy is based largely on agriculture while Ontario has an industrial based economy. The agricultural industry in Saskatchewan is widely dispersed while the manufacturing activity in Ontario is concentrated in a relatively small area of the province. These factors may account for the difference in types and extent of roads in Ontario and Saskatchewan. Rural roads are maintained by rural municipalities and this may account for the relatively large involvement of municipal governments in transportation expenditure in Saskatchewan. Municipal governments make

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[12]See Dominion Bureau of Statistics, Road and Street Mileage and Expenditure, 1964, No. 53-201, Table 2.

TABLE 10

Per Capita Expenditure on Transportation and Communication, 10 Provinces 1962-1964

Province	Per Capita Expenditure Average 1962-64	Per Cent Municipal 1964
Newfoundland	$ 56.76	12.0
Prince Edward Island	73.34	8.5
Nova Scotia	46.31	14.7
New Brunswick	57.00	15.4
Quebec	44.92	12.8
Ontario	74.47	39.8
Manitoba	61.51	41.9
Saskatchewan	65.12	46.0
Alberta	72.27	41.4
British Columbia	70.44	31.6
Mean	62.21	26.4
Standard Deviation (n = 30)	11.20	

Source: Computed from data in Consolidated Government Finance, 1962 to 1964, Table 7.

up 46 per cent of total provincial-municipal expenditure in Saskatchewan; this is almost 20 per cent higher than the national average.

The density of population appears to have a small inverse effect on expenditure, perhaps indicating that there may be economics of scale in densely populated areas. Value added by manufacturing establishments, and personal income were expected a priori to be positively associated with transportation expenditure. The correlation coefficients between density, value added, and income and expenditure are -0.07, 0.13, and 0.44 respectively.[13]

An obvious determinant of transportation expenditure is the motor vehicle, the object which creates the need for good roads. The more vehicles, the greater is the need for public expenditure on roads. The simple correlation between expenditure on roads and motor vehicles per capita is 0.62. The number of motor vehicles is strongly related to the level of personal income; the correlation between these two variables is 0.79. The observed positive correlation between income and expenditure may be due to the association between motor vehicles and income. Income was included as an explanatory variable in the regression analysis because high income people, as well as buying more automobiles, also might be expected to make greater use of their vehicles. Thus two provinces with the same number of vehicles per capita but with differing levels of income might experience different intensities of road use. Non-tax revenue is included in the equations on the assumption that provinces enjoying a high level of non-tax revenue may use this revenue to finance road construction. An obvious example is the Province of Alberta. The

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[13] See Table 2.

variables are designated as follows: Y_7 is per capita transportation expenditure; X_1 is personal disposable income per capita; X_2 is non-tax revenue per capita; and X_5 is the number of motor vehicles per capita. The regression equations are estimated to be:

$$Y_7 = 33.96 - 0.0056X_1 - 0.00073X_2 + 110.60X_5 + 0.97D_2 + 2.28D_3 \quad (14)$$
$$t: \qquad (-0.60) \quad (-0.01) \quad (2.50) \quad (0.23) \quad (0.53)$$
$$\bar{R}^2 = 0.28$$

$$\log Y_7 = 4.63 - 0.18\log X_1 + 0.02\log X_2 + 0.49\log X_5 + 0.03\log D_2$$
$$t: \qquad (-0.75) \quad (0.28) \quad (2.40) \quad (0.36)$$
$$+ 0.05\log D_3 \qquad (15)$$
$$(0.68)$$
$$\bar{R}^2 = 0.23$$

Income and non-tax revenue do not appear to have a significant influence on transportation expenditure. The regression coefficients exhibit a sign opposite to that expected in three of four cases and are not significantly different from zero. Motor vehicles per capita appears to influence expenditure in the manner expected. The poor results may be due to multicollinearity; the simple correlation between X_1 and X_5 is 0.79; between X_1 and X_2, 0.56; and between X_2 and X_5, 0.69. Non-tax revenue alone was regressed against expenditure. The regression coefficient is positive and significantly different from zero but the equation itself is not significant at the .01 significance level.[14]

The influence of motor vehicles per capita was further tested by dropping the other two variables from the regression equations. The results are:

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[14] F values are less than the critical value of 4.64.

$$Y_7 = 31.96 + 92.13X_5 + 0.83D_2 + 2.03D_3 \quad (16)$$

t: (4.01) (0.20) (0.49)

$\bar{R}^2 = 0.33$

$$\log Y_7 = 4.58 + 0.41\log X_5 + 0.02\log D_2 + 0.05\log D_3 \quad (17)$$

t: (3.59) (0.34) (0.64)

$\bar{R}^2 = 0.28$

These equations confirm the influence of the motor vehicles variable. The amount of variation explained actually increases by dropping the income and non-tax variables although the explained variation remains low. It appear that this is one function of government where increases in expenditure in the private sector obviously lead to increases in expenditure in the public sector. The regression coefficient of 0.41 in equation (17) can be interpreted to mean that for every 10 per cent increase in motor vehicles per capita, government expenditure for roads rises by 4.1 per cent.

This chapter has examined provincial and municipal government expenditures for education, health, welfare and transportation. In Chapter III expenditure on other functions is investigated.

CHAPTER III

EXPENDITURE ON OTHER FUNCTIONS

This chapter examines provincial and municipal government expenditure on sanitation, natural resources, debt charges, general government, protection to persons and property, and "other" expenditure. The variation in per capita expenditure among the provinces is briefly outlined and the results of the multiple regression analysis involving these expenditure categories are presented. The latter part of this chapter examines total expenditure.

Expenditure for sanitation and waste removal showed wide variation among the provinces in 1962 to 1964, as can be seen from Table 11. Expenditure on this purely municipal function varied from $0.97 per capita in Prince Edward Island to $16.81 per capita in Ontario. Expenditure in the Province of Quebec was $2.62, far below the national average of $7.04.

Part of the variation in expenditure may be explained by social and political attitudes about the priority of waste removal. For example, only four municipalities dump raw sewage in Ontario, while in Quebec, 90 per cent of the province's sewage is dumped into lakes and streams with no treatment. Responsibility for pollution in Ontario rests with the Ontario Water Resources Commission which had a budget of $42

million in 1969 while the budget of Quebec Water Board was only $700,000.[1]

Non-tax revenue, X_2, rate of population growth, X_{13}, value added by manufacturing, X_4, and personal income, X_1, show significant positive simple correlation with sanitation expenditure. The multiple regression equations involving these variables are estimated to be:

$$Y_4 = -15.86 + 0.016X_1 - 0.017X_2 - 0.0012X_4 + 0.14X_{13} - 0.74D_2$$
$$t: \qquad (4.92) \quad (-0.78) \quad (-0.31) \quad (1.60) \quad (-0.68)$$
$$- 1.42D_3 \qquad (1)$$
$$(-1.23)$$
$$\bar{R}^2 = 0.80$$

$$\log Y_4 = 0.80 + 4.52\log X_1 - 0.39\log X_2 - 0.61\log X_4 + 0.95\log X_{13}$$
$$t: \qquad (5.10) \quad (-1.26) \quad (-2.05) \quad (3.14)$$
$$- 0.15\log D_2 - 0.14\log D_3 \qquad (2)$$
$$(-0.76) \quad (-0.69)$$
$$\bar{R}^2 = 0.80$$

These equations show that personal income and the rate of population growth have a significant positive effect on sanitation expenditure. Population growth necessitates new facilities while areas of high income may demand higher standards of sanitation. X_2 and X_4 have negative regression coefficients. This is an unexpected result since value added measures industrial activity and an industrial area is assumed to produce more waste than a non-industrial area. High non-tax revenue

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[1]These data appear in "To Stem Pollution's Ugly Tide", Time, July 11, 1969, p. 12. Provincial expenditures for water control are classified under natural resource expenditure. The Ontario Water Resources Commission has powers which it has used to encourage municipal governments to install sewage treatment plants, the expenditures for which then appear under sanitation expenditure.

levels may encourage better waste removal. Multicollinearity was suspected as the cause of the poor results. Variables X_1 and X_{13} were dropped from the regression in order to test the influence X_2 and X_4. The results are:

$$Y_4 = 0.90 + 0.057X_2 + 0.012X_4 - 0.65D_2 - 1.80D_3 \quad (3)$$
$$t: \qquad (4.28) \quad (5.70) \quad (-0.43) \quad (-1.18)$$
$$\bar{R}^2 = 0.62$$

$$\log Y_4 = -1.49 + 0.98\log X_4 + 0.61\log X_4 - 0.19\log D_2 - 0.28\log D_3 \quad (4)$$
$$t: \qquad (4.89) \quad (3.85) \quad (-0.70) \quad (-1.03)$$
$$\bar{R}^2 = 0.61$$

These equations show that the influence of non-tax revenue and value added is positive and significantly different from zero. The influence of the four explanatory variables is thus as predicted.

As can be seen from Table 12, expenditure for natural resources and primary industry was a provincial responsibility in 1964; municipal governments made no expenditures in this category. Per capita expenditure varied from $6.03 in Newfoundland and $6.85 in Ontario to $20.04 in Manitoba. The national average in 1964 was $11.92.

Expenditure for this function was regressed against personal income, X_1, natural resource revenue, X_3, population density, X_6, and federal conditional grants for natural resources, X_{12}. The equations are:

$$Y_8 = 3.83 + 0.0021X_1 + 0.065X_3 + 0.0095X_6 + 1.87X_{12} - 0.29D_2$$
$$t: \qquad (1.02) \quad (3.51) \quad (0.63) \quad (6.65) \quad (-0.36)$$
$$- 0.41D_3 \quad (5)$$
$$(-0.26)$$
$$\bar{R}^2 = 0.76$$

TABLE 11

Average Per Capita Expenditure on Other Functions

10 Provinces, 1962-1964

Province	Sanitation	Natural Resources	Debt Charges	General Government	Protection	Recreation	Other
Newfoundland	$ 2.94	$ 8.27	$ 16.96	$ 14.18	$ 9.65	$ 1.45	$ 4.02
Prince Edward Island	0.97	9.72	25.71	14.88	9.77	3.90	6.09
Nova Scotia	3.23	6.03	23.31	12.77	15.01	3.35	6.79
New Brunswick	2.35	8.83	22.83	13.67	14.32	3.48	8.02
Quebec	2.62	13.39	18.35	19.10	22.85	4.22	25.61
Ontario	16.81	6.85	21.35	18.66	29.28	9.11	7.03
Manitoba	8.24	20.04	13.00	17.10	21.94	6.53	6.58
Saskatchewan	8.18	15.92	5.69	18.24	19.69	10.65	9.56
Alberta	10.26	15.37	1.04	15.57	29.98	11.47	7.71
British Columbia	14.83	14.82	11.00	20.38	29.65	11.05	19.73
Mean	7.04	11.92	15.92	16.46	20.21	6.52	10.11
Standard Deviation (n = 30)	5.45	4.91	8.06	2.90	7.66	3.66	6.81

Source: Computed from data in Consolidated Government Finance, 1962 to 1964, Table 7.

TABLE 12

Per Cent Municipal Responsibility, Other Functions

10 Provinces, 1964

Province	Sanitation %	Natural Resources %	General Government %	Protection %	Recreation %
Newfoundland.....	100	0	17	15	60
Prince Edward Island.....	100	0	16	48	41
Nova Scotia.....	100	0	41	67	40
New Brunswick.....	100	0	41	66	72
Quebec.....	100	0	51	59	81
Ontario.....	100	0	59	69	78
Manitoba.....	100	0	63	66	75
Saskatchewan.....	100	0	49	52	63
Alberta.....	100	0	64	58	81
British Columbia.....	100	0	39	65	82
Mean.....	100	0	44	57	67

Source: Computed from data in Consolidated Government Finance, 1964, Table 7.

$$\log Y_8 = 1.81 + 0.06\log X_1 + 0.13\log X_3 + 0.61\log X_6 + 0.44\log X_{12}$$

$$t: \qquad (0.23) \qquad (3.54) \qquad (0.91) \qquad (5.48) \qquad (6)$$

$$- 0.02\log D_2 - 0.64\log D_3$$

$$(-0.16) \qquad (-0.59)$$

$$\bar{R}^2 = 0.69$$

These equations indicate that the main determinants of natural resource expenditure is revenue from natural resources and federal government conditional grants. The influence of personal income and population density is not significantly different from zero. The regression coefficient for density was expected to be negative on the assumption that greater expenditures on natural resources would occur in provinces with low density. The result may be due to the specification of the density variable which is the number of persons per square mile of privately owned land. An improved definition for use in explaining variation in natural resource expenditure may be the ratio of persons to the total area of a province. Since many of the expenditures in this category relate to agriculture, the percentage of population living in rural areas may bear a positive relation to expenditure.

Per capita expenditure on debt charges is shown in Table 11. Expenditure varies from $25.71 per capita in Prince Edward Island to $1.04 per capita in Alberta, with the national average being $15.92.

This category of expenditure is net of revenue received from interest yielding assets. For some provinces such as Alberta, the interest received on provincially held securities exceeds the amount paid out by the provincial government. Debt charges expenditure by municipal governments in Alberta, however, exceeds the net negative expenditure of the provincial government resulting in the positive,

combined total of $1.04 per person. The amount paid out for debt charges is partly determined by the age and structure of government debt and reflects the accumulated decisions of the past. The use of provincial crown corporations to borrow money makes this variable even more ambiguous.

Because wealthy provinces may have less need to borrow funds, a negative association between variables such as personal income, X_1, and non-tax revenue, X_2, might be expected. Governments in high density areas may be under greater pressure to provide public services than governments in less densely populated areas; density, X_6, should show a positive influence on debt charge expenditure. Areas of high growth are hypothesized to spend money on expanding facilities and may be forced to borrow funds to provide these services. There should be a positive association between debt charges and the rate of population growth, X_{13}. The regression equations are:

$$Y_9 = 26.84 - 0.0068X_1 - 0.076X_2 + 0.076X_6 - 0.16X_{13} + 3.00D_2$$
$$t: \qquad (-2.06) \quad (-2.10) \quad (2.25) \quad (-1.14) \quad (1.69)$$
$$+ 5.01D_3 \qquad (7)$$
$$(2.64)$$
$$\bar{R}^2 = 0.77$$

$$\log Y_9 = 6.42 + 1.11\log X_1 - 1.15\log X_2 + 0.52\log X_6 - 0.61\log X_{13}$$
$$t: \qquad (2.60) \quad (-4.40) \quad (3.83) \quad (-3.14)$$
$$+ 0.18\log D_2 + 0.36\log D_3 \qquad (8)$$
$$(1.20) \quad (2.23)$$
$$\bar{R}^2 = 0.88$$

The influence of population density and non-tax revenue is as expected while the influence of population growth is opposite to what was expected. The explanation may lie in the specification of the growth

variable. It is a 10 year growth rate while the debt variable reflects many decisions made more than 10 years previously. The influence of personal income is not conclusive; the sign of the regression coefficient is as expected in equation (7) but the coefficient becomes positive in equation (8).

Expenditures for general government showed less variation than expenditures for other functions. Per capita expenditures were below the national average in Alberta and the four Atlantic provinces, and above the average in the other provinces. The mean expenditure for all provinces for the years 1962 to 1964 was $16.46 and the standard deviation was $2.90. The proportion of municipal expenditure showed wide variation, however, ranging from 16 per cent in Prince Edward Island, and 17 per cent in Newfoundland to 64 per cent in Alberta in 1964. The effect of the level of personal income, X_1, non-tax revenue, X_2, value added, X_4, and population growth, X_{13}, on expenditure for general government was tested. The regression equations are:

$$\begin{aligned} Y_{10} &= 4.57 + 0.0083X_1 - 0.27X_2 - 0.0017X_4 + 0.84X_{13} \\ t: &\qquad\quad (3.17) \quad (-1.50) \quad (-0.52) \quad (1.14) \\ &\quad + 0.73D_2 + 2.03D_3 \\ &\quad\ (0.81) \quad (2.14) \\ \bar{R}^2 &= 0.54 \end{aligned} \tag{9}$$

$$\begin{aligned} \log Y_{10} &= 2.68 + 0.71\log X_1 - 0.10\log X_2 - 0.37\log X_4 + 0.66\log X_{13} \\ t: &\qquad\quad (2.67) \quad (-1.07) \quad (-0.42) \quad (0.72) \\ &\quad + 0.04\log D_2 + 0.11\log D_3 \\ &\quad\ (0.68) \quad (1.74) \\ \bar{R}^2 &= 0.47 \end{aligned} \tag{10}$$

The influence of non-tax revenue and value added appears to be contrary to the expected result. Again multicollinearity was suspected as the cause, and the influence of these two variables was tested separately with the following results:

$$Y_{10} = 12.50 + 0.013X_2 + 0.0056X_4 + 0.76D_2 + 1.80D_3 \quad (11)$$
$$t: \qquad (1.43) \quad (3.84) \quad (0.74) \quad (1.74)$$
$$\bar{R}^2 = 0.38$$

$$\log Y_{10} = 2.50 + 0.09\log X_2 + 0.11\log X_4 + 0.04\log D_2 + 0.10\log D_3 \quad (12)$$
$$t: \qquad (1.88) \quad (2.83) \quad (0.65) \quad (1.53)$$
$$\bar{R}^2 = 0.33$$

These equations show the influence of non-tax revenue and value added to be positive.

Per capita expenditures for fire and police protection varied from $9.65 in Newfoundland to $29.98 in Alberta with a mean of $20.21 and standard deviation of $7.66. The municipal share of this expenditure varied from 15 per cent in Newfoundland to 69 per cent in Ontario.

The influence of personal income, X_1, non-tax revenue, X_2, value added per capita, X_4, and motor vehicles per capita, X_5, is expected to be positive. For example, the more motor vehicles, the greater is the need for police to control traffic; and the greater the amount of industrial activity, the greater is the need for fire protection equipment. The equations are estimated to be:

$$Y_{11} = -1.81 + 0.0088X_1 + 0.77X_2 + 0.013X_4 - 0.22X_5$$
$$t: \qquad (3.04) \quad (8.57) \quad (6.69) \quad (-0.02)$$
$$- 0.58D_2 - 0.86D_3 \quad (13)$$
$$(-0.82) \quad (-1.20)$$
$$\bar{R}^2 = 0.96$$

$$\log Y_{11} = 2.20 + 0.48\log X_1 + 0.28\log X_2 + 0.29\log X_4 + 0.17\log X_5$$
$$t: \qquad (2.70) \qquad (7.22) \qquad (8.67) \qquad (1.50)$$
$$-0.04\log D_2 - 0.06\log D_3 \qquad (14)$$
$$(-1.25) \qquad (-1.72)$$
$$\bar{R}^2 = 0.97$$

The influence of all variables is as predicted with the exception of motor vehicles per capita. The regression coefficient has a change of sign in the two models and is not significant at the .05 level. Income and non-tax revenue are highly correlated with motor vehicles per capita and thus multicollinearity may be the cause of the poor parameter estimates for X_5. The influence of X_5 is as predicted in the following equations, however.

$$Y_{11} = -4.95 + 0.016X_4 + 59.48X_5 - 0.32D_2 - 0.13D_3 \qquad (15)$$
$$t: \qquad (7.01) \qquad (6.65) \qquad (-0.20) \qquad (-0.08)$$
$$\bar{R}^2 = 0.79$$

$$\log Y_{11} = 4.45 + 0.39\log X_4 + 0.89\log X_5 - 0.03\log D_2 - 0.02\log D_3 \qquad (16)$$
$$t: \qquad (9.32) \qquad (7.90) \qquad (-0.40) \qquad (-0.28)$$
$$\bar{R}^2 = 0.86$$

Per capita expenditures for recreation varied greatly among the provinces. Expenditure was only $1.45 per person in Newfoundland, while in Alberta the expenditure was almost eight times as great at $11.47.

Four determinants of recreation expenditure were tested by multiple correlation techniques. High income groups may demand greater recreation and cultural services. Motor vehicles per capita are expected to have a positive influence on expenditure because a high value for this variable may reflect a greater mobility of the population and enable them to take advantage of recreational facilities where they

exist. The motor vehicle may lead to demands for the provision of new facilities and the greater utilization of existing facilities. Areas of rapid population growth may be expected to experience greater demands for public recreation services. On the supply side, the availability of funds derived from non-tax revenue may encourage governments to spend a greater amount on this type of public good which could be considered a luxury good. The regression equations below confirm the above hypotheses. The four variables explain over 90 per cent of the variation in recreation expenditures.

$$Y_{12} = -7.86 + 0.0041X_1 + 0.020X_2 + 22.38X_5 + 0.023X_{13} \qquad (17)$$
$$t: \qquad (2.66) \quad (2.45) \quad (3.07) \quad (0.68)$$
$$- 0.45D_2 - 0.52D_3$$
$$(-1.04) \quad (-1.12)$$
$$\bar{R}^2 = 0.93$$

$$\log Y_{12} = 2.26 + 0.96\log X_1 + 0.18\log X_2 + 1.47\log X_5 + 0.05\log X_{13} \qquad (18)$$
$$t: \qquad (3.34) \quad (1.92) \quad (5.10) \quad (0.62)$$
$$- 0.02\log D_2 - 0.05\log D_3$$
$$(-0.34) \quad (-0.70)$$
$$\bar{R}^2 = 0.96$$

The "other" expenditure category is a residual consisting mainly of miscellaneous and sundry items of expenditure. It is thus difficult to make predictions about the determinants of this type of expenditure. Included in this category are expenditures for trade promotion and industrial development. It was decided to regress other expenditure against value added by manufacturing. The equation is:

$$
\begin{aligned}
Y_{13} &= 5.53 + 0.011X_4 - 0.12D_2 + 1.03D_3 \\
t: &\qquad\qquad (2.65) \quad (-0.04) \quad (0.36) \\
\bar{R}^2 &= 0.14
\end{aligned}
\tag{19}
$$

Although the regression coefficient is significant at the .05 level, the equation itself is not significant at the .01 level.

Total Expenditure

Per capita total expenditure and total revenue by province for 1962 to 1964 are shown in Table 13. The average expenditure of all provinces was $310.59 per capita with a standard deviation of $51.78. The four Atlantic Provinces and Manitoba spent less than the average and the highest expenditure occurred in Saskatchewan at $366.85 per capita. Per capita total revenue showed a similar ranking; these figures indicate that provincial and municipal governments in all provinces except Alberta operated at a deficit. The municipal share of total expenditure varied from 8.3 per cent in Newfoundland in 1964 to 46.5 per cent in Ontario. The average municipal share was 34.4 per cent of combined provincial-municipal expenditure; the municipal share of total revenue was 34.0 per cent.

Since total expenditure is the sum of expenditure on the individual functions, the determinants of total expenditure will be some combination of all the determinants of expenditure on individual functions. These determinants vary from function to function and thus it is more useful to examine the functions individually. However, four independent variables which appeared to be significant in explaining variation in several individual functions, were chosen to be regressed against total expenditure. These variables are the level of personal income, X_1, non-tax revenue, X_2, value added by manufacturing establishments, X_4, and the rate of population growth, X_{13}. The equations are estimated to be:

TABLE 13

Per Capita Total Expenditure and Total Revenue

by Province, 1962-1964

Province	Per Capita Expenditure Average 1962-64	Per Cent Municipal 1964	Per Capita Revenue Average 1962-64	Per Cent Municipal 1964
Newfoundland	$247.20	8.3	$191.41	8.2
Prince Edward Island	283.12	24.8	220.01	16.7
Nova Scotia	243.66	31.6	228.65	30.2
New Brunswick	257.57	34.3	230.11	29.3
Quebec	316.05	32.8	272.26	29.5
Ontario	359.76	46.5	315.27	39.9
Manitoba	308.13	41.5	257.47	40.0
Saskatchewan	366.85	39.4	355.09	34.0
Alberta	359.55	44.4	365.56	33.0
British Columbia	364.06	40.5	353.70	31.1
Mean	310.59	34.4	278.95	34.0
Standard Deviation (n = 30)	51.78		64.85	

Source: Computed from data in Consolidated Government Finance, 1962 to 1964, Tables 6 and 7.

$$Y_{14} = 134.47 + 0.11X_1 + 0.43X_2 + 0.031X_4 - 0.84X_{13}$$
$$t: \qquad (3.44) \quad (2.00) \quad (0.82) \quad (-0.98) \qquad (20)$$
$$+ 2.47D_2 + 14.73D_3$$
$$(0.24) \quad (1.33)$$
$$\bar{R}^2 = 0.80$$

$$\log Y_{14} = 5.23 + 0.57\log X_1 + 0.07\log X_2 - 0.03\log X_4 - 0.004\log X_{13}$$
$$t: \qquad (3.46) \quad (1.16) \quad (-0.46) \quad (-0.64) \qquad (21)$$
$$+ 0.011\log D_2 + 0.06\log D_3$$
$$(0.38) \quad (1.56)$$
$$\bar{R}^2 = 0.78$$

These equations indicate that only the level of personal income is a significant determinant of total expenditure. However, the high coefficients of determination 0.80 and 0.78 and the poor parameter estimates again indicate multicollinearity. A general solution to this problem which has arisen in several functions is proposed in the following chapter.

This chapter has examined variation in provincial and municipal government expenditure and the determinants of expenditure for the following categories: sanitation, natural resources, debt charges, general government, protection, recreation, other and total expenditure. Chapter IV summarizes the results of Chapters I to III and sets out the conclusions of the study.

CHAPTER IV

SUMMARY AND CONCLUSIONS

This paper has outlined the variation in combined provincial and municipal government expenditure by functional category among the provinces of Canada for the years 1962, 1963 and 1964. Hypotheses have been postulated to explain the variation and have been tested by means of simple correlation and multiple regression techniques. In addition to statistical hypotheses, non-quantifiable reasons for the observed variation in expenditure have been discussed in a literary fashion. Expenditures on certain functions may vary among the provinces because of variation in the quality and price of the services provided, the level of government performing the service, or the political attitudes of present and past governments, as well as because of differences in economic and demographic factors.

A pooled time-series and cross-section analysis approach was used to test the statistical hypotheses. Cross-section data for the 10 provinces from each of the three years 1962 to 1964 was pooled by the use of dummy variables. This technique, which has been described in detail in Chapter I, increases the number of observations to 30 from 10 and permits more reliable estimates of regression parameters to be calculated. Two basic mathematical models were used for the multiple regression equations, namely, a simple additive model and a double logarithmic model.

The results of the simple correlation analysis between expenditure categories and certain economic variables which were expected to have a major influence on expenditure have been discussed in detail in Chapter I. It was found that, in general, there is not a high degree of correlation among the various expenditure categories. This suggested that each function be examined individually since the low correlation suggested that various functions were not determined by the same underlying factors.

Each functional category of expenditure has been examined individually, in detail, in Chapters II and III. Per capita expenditure on education, health, social welfare and transportation has been discussed in Chapter II. These four major functions accounted for more than 70 per cent of combined provincial and municipal spending between 1962 and 1964.

Personal income per capita, non-tax revenue per capita, value added per capita and the pupil/teacher ratio in public schools were found to be significant in explaining the variation in education expenditures.

Federal government conditional grants to the provinces under the Federal Hospital Insurance and Diagnostic Services Act were found to be the strongest factor associated with health expenditures. The grants variable by itself explained 33 per cent of the variation, while the addition of the personal income, non-tax revenue, population density and private expenditure on health variables increased the explanatory power to only 43 per cent.

The rate of population growth and federal conditional welfare grants were found to be significant determinants of social welfare

expenditure. Again, the conditional grants variable was the most important determinant; alone, it explained 52 per cent while the addition of the personal income and population growth variables raised $\bar{R}^2$ to 0.66.

Transportation expenditure was most strongly associated with the number of motor vehicles per capita. This variable explained 33 per cent of the variation. The addition of personal income and non-tax revenue decreased $\bar{R}^2$ to 0.28.

Chapter III considered the determinants of expenditure of the other functions of government, namely, expenditures for sanitation, natural resources, debt charges, general government, protection and "other" expenditure.

Non-tax revenue, rate of population growth, value added and personal income were found to be significant in explaining the variation in per capita expenditure on sanitation while the main determinants of natural resource expenditure were found to be revenue from natural resources and conditional grants from the federal government. Debt charges were significantly influenced by non-tax revenue and population density while per capita expenditures for fire and police protection appeared to be determined by personal income, non-tax revenue, value added and motor vehicles per capita. Personal income and value added were important factors influencing general government expenditure, a function which showed less variation among the provinces than did the other functions. Over 90 per cent of the variation in recreation expenditures could be explained by personal income, non-tax revenue and population growth.

Four independent variables were significant in explaining the variation in several individual functions and these were regressed against total expenditure. The variables, which were personal income, non-tax revenue, value added by manufacturing and the rate of population growth, together accounted for 80 per cent of the variation in total expenditure, although only the personal income regression coefficient was significant.

The problem of high $\bar{R}^2$ values and poor parameter estimates is caused by multicollinearity, a situation which arose in some of the regression equations for nearly all functions. Several explanatory variables, which in many cases it was desirable to include as distinct variables, were interrelated to such a degree that the signs of some coefficients were opposite to that expected. This was usually overcome by testing the influence of such variables in separate equations. Such a procedure is not desirable, however, because of the lack of a total, reliable measure of the amount of variation explained by all the relevant variables. A solution to the multicollinearity problem as it relates to determinants of government expenditure has been proposed by G.B. Pidot, Jr.[1] He suggests a principal components analysis in which interactions of independent variables are eliminated by creating a set of new variables which are linear combinations of the original ones. Such an approach was beyond the scope of this paper but the topic is suggested as a field for further research into the factors which determine provincial and municipal government expenditure in Canada.

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[1]G.B. Pidot,Jr., "A Principal Components Analysis of the Determinants of Local Government Fiscal Patterns", Review of Economics and Statistics, LI (May, 1969), pp. 176-88.

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APPENDIXES

APPENDIX A

DATA

The Dominion Bureau of Statistics classifies expenditure into several functional categories. The expenditure categories considered in this study are health, sanitation, social welfare, education, transportation, natural resources and primary industry, debt charges excluding debt retirement, general government, protection, recreation, and other. "Other" expenditure includes "trade and industrial development, local government planning and development, civil defence and other unspecified expenditures" at the provincial level; and "provisions for reserves, contributions to capital and loan fund, joint and special expenditures, and sundry, miscellaneous items" at the municipal level.[1]

Net general expenditures and revenues of the provincial and municipal governments are consolidated in the Dominion Bureau of Statistics publication, Consolidated Government Finance. The term "general" includes "current (ordinary) and capital budgetary transactions as well as certain non-budgetary transactions ..., which are excluded from government budgetary provisions but which are, for these statistical series, included as an integral part of government."[2]

The term "net" means that the gross revenues and expenditures have been adjusted as follows: (a) "revenue in the form of grants-in-aid and shared-cost contributions (conditional grants) are offset against the

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[1]Dominion Bureau of Statistics, Consolidated Government Finance, No. 68-202, 1964, (Ottawa: Queen's Printer, 1968), p. 6.

[2]Ibid, p. 5.

corresponding functional items of expenditure;" (b) revenue derived from sources related to functions of expenditure are offset against expenditure on such functions;" (c) " revenue in the form of interest, premium discounts and exchange transactions is offset against debt charges."[3] Provincial-municipal transfers have been eliminated from revenues and expenditures. Federal unconditional grants are included in revenue and the expenditure of amounts derived from unconditional grants is included in expenditure.

Revenue and expenditure of all government enterprises, and municipal hospitals, libraries, and other special activities of local government are excluded. Profits of government enterprises are included in revenue and losses in expenditure.

The data are for the fiscal years ended nearest December 31. The fiscal year-end of the federal and provincial governments in Canada is March 31. The fiscal year-end of municipalities and school boards in all provinces except Quebec is December 31. In the Province of Quebec the fiscal year-end of municipalities is April 30 and that of school boards is June 30.

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[3] Ibid, p. 6.

APPENDIX B

DESCRIPTION OF VARIABLES

Expenditure Categories

The provincial and municipal government expenditure categories are recorded in terms of current dollars per capita, calculated from data appearing in Dominion Bureau of Statistics, Consolidated Government Finance, No. 68-202, 1962 to 1964 inclusive, (Ottawa: Queen's Printer, 1965, 1967, 1968), Table 7.

Revenue Categories

The provincial and municipal government revenue categories are recorded in terms of current dollars per capita, calculated from data appearing in Dominion Bureau of Statistics, Consolidated Government Finance, No. 68-202, 1962 to 1964 inclusive, Table 6.

Other Variables

1. Personal disposable income per capita, 1962 to 1964.

   Source: Financial Post, Survey of Markets and Business Yearbook, 1963, p. 19; 1964/65, p. 17, and 1965/66, p. 7.

2. Retail sales per capita, 1962 to 1964.

   Source: Ibid.

3. Average weekly earnings of wage earners and salaried employees, 1962 to 1964.

   Source: Ibid.

4. Population, 1962 to 1964.

   Source: Dominion Bureau of Statistics, Canada Yearbook, 1968, p. 212.

5. Rate of population growth: 10 year simple growth rate expressed in percentage terms, 1952 to 1962; 1953 to 1963; and 1954 to 1964.

   Source: Ibid.

6. Density of population: persons per square mile of privately-owned land, 1962 to 1964.

   Source: Dominion Bureau of Statistics, Canada Yearbook, 1963-64, p.32; 1965, p.25; 1966, p. 20; 1968, p. 212.

7. Number of motor vehicles per capita, 1962 to 1964.

   Source: Dominion Bureau of Statistics, Canada Yearbook, 1968, p. 212, 813.

8. Per capita value added by total activity of manufacturing establishments, 1962 to 1964.

   Source: Dominion Bureau of Statistics, Canada Yearbook, 1967, p. 688-89.

9. Per capita federal government conditional grants to provinces and municipalities, by function, 1962 to 1964.

   Source: Dominion Bureau of Statistics, Federal Government Finance, No. 68-211, 1962 to 1964 inclusive, Table 5.

10. Pupil/teacher ratio in publicly controlled elementary and secondary schools, school years ending in 1962, 1963 and 1964.

    Source: Dominion Bureau of Statistics, Preliminary Statistics of Education, No. 81-201, 1961-62 to 1963-64 inclusive, Table 2.

11. Pupil/teacher ratio in private schools, school years ending in 1962, 1963 and 1964.

    Source: Ibid.

12. Per capita private expenditure on health, 1962 to 1964: income of medical doctors and surgeons divided by population.

    Source: Department of National Revenue, Taxation Statistics, 1964, Table 8; 1965, 1966, Table 9; Dominion Bureau of Statistics, Canada Yearbook, 1968, p. 212.

APPENDIX C

DESIGNATION OF VARIABLES IN MULTIPLE REGRESSION EQUATIONS

Y_1: Per capita hospital care expenditure

Y_2: Per capita other health expenditure

Y_3: Per capita total health expenditure

Y_4: Per capita sanitation and waste removal expenditure

Y_5: Per capita social welfare expenditure

Y_6: Per capita education expenditure

Y_7: Per capita transportation and communication expenditure

Y_8: Per capita natural resource and primary industries expenditure

Y_9: Per capita debt charges exluding debt retirement

Y_{10}: Per capita general government expenditure

Y_{11}: Per capita protection of persons and property expenditure

Y_{12}: Per capita recreation and cultural services expenditure

Y_{13}: Per capita other expenditure

Y_{14}: Per capita total consolidated general expenditure after elimination of provincial-municipal transfers

X_1: Per capita personal disposable income

X_2: Per capita non-tax revenue (excludes federal aid)

X_3: Per capita natural resource revenue

X_4: Per capita value added by total manufacturing activity

X_5: Number of motor vehicles per capita

X_6: Population per square mile of privately owned land

X_7: Pupil/teacher ratio, private schools

X_8: Pupil/teacher ratio, publicly controlled elementary and secondary schools

X_9: Per capita federal government conditional social welfare grants

X_{10}: Per capita federal government conditional health grants

X_{11}: Total income of medical doctors divided by provincial population

X_{12}: Per capita federal government conditional natural resources grants

X_{13}: Rate of population growth: 10 year simple average expressed in percentage terms

D_2: Dummy variable, equals 1 if 1963, and 0 otherwise

D_3: Dummy variable, equals 1 if 1964, and 0 otherwise

APPENDIX D

CORRELATION BETWEEN SELECTED VARIABLES

Tables 1 and 3 in Appendix D indicate the simple correlation between the expenditure categories and independent variables which entered the multiple regression analysis. Tables 2 and 4 indicate the simple correlation between these independent variables. The data from which Tables 1 and 2 were computed are untransformed, while the data from which Tables 3 and 4 were computed are in logarithmic form.

APPENDIX D

TABLE 1

Coefficients of Simple Correlation, Expenditure Categories and Variables Entering Regression Equations, 10 Provinces 1962-1964 *

	Health	Sanitation	Social Welfare	Education	Trans-portation	Natural Resources	Debt Charges	General Government	Protection	Recreation	Other	Total Expenditure
Population growth.....	-0.15	0.61	0.40	0.39	0.20	0.11	-0.42	0.39	0.74	0.45	0.38	0.44
Personal income per capita.	0.35	0.89	-0.02	0.81	0.44	0.46	-0.51	0.72	0.91	0.87	0.33	0.88
Value added per capita.....	-0.14	0.65	-0.01	0.39	0.13	-0.08	0.12	0.58	0.70	0.31	0.47	0.46
Natural resource revenue...	0.22	0.40	0.24	0.64	0.40	0.40	-0.78	0.14	0.60	0.71	0.07	0.56
Total non-tax revenue.....	0.32	0.48	0.21	0.72	0.43	0.47	-0.82	0.24	0.67	0.79	0.11	0.66
Motor vehicles per capita..	0.37	0.65	-0.26	0.85	0.62	0.50	-0.56	0.47	0.67	0.91	0.09	0.80
Population density.....	-0.31	0.27	0.19	0.02	-0.07	-0.37	0.43	0.40	0.27	-0.11	0.48	0.11
Health grant.....	0.57	0.21	0.02	0.42	0.19	0.25	-0.07	0.33	0.31	0.34	0.02	0.49
Welfare grant.....	0.18	-0.29	0.76	-0.31	-0.10	0.16	-0.07	0.16	-0.29	-0.24	0.20	-0.09
Natural resource grant.....	0.14	-0.01	-0.18	-0.03	0.02	0.73	-0.09	0.21	0.01	0.05	-0.15	0.06
Pupil/teacher ratio private schools.....	-0.24	0.25	-0.41	0.23	0.26	0.18	-0.10	-0.00	0.22	0.32	-0.05	0.13
Pupil/teacher ratio public schools.....	-0.26	0.13	-0.16	-0.47	0.12	-0.62	0.43	-0.25	-0.28	-0.32	-0.47	-0.38
Doctors' income per capita.	0.21	0.80	-0.12	0.78	0.46	0.34	-0.28	0.71	0.88	0.76	0.41	0.83

* Untransformed data

Source: Computed from data itemized in Appendix B.

APPENDIX D

TABLE 2

Coefficients of Simple Correlation Between Independent Variables Entering Regression Equations, 10 Provinces, 1962-1964

	Population Growth	Personal Income	Value Added	Resource Revenue	Non-tax Revenue	Motor Vehicles	Population Density	Health Grant	Welfare Grant	Natural Resource Grant	Private Pupil/ teacher Ratio	Public Pupil/ teacher Ratio
Population growth.....	1.00											
Personal income.....	0.50	1.00										
Value added per capita.....	0.61	0.62	1.00									
Natural resource revenue....	0.55	0.45	-0.05	1.00								
Total non-tax revenue.....	0.53	0.56	0.00		1.00							
Motor vehicles per capita...	0.15	0.79	0.15	0.59	0.69	1.00						
Population density.....	0.44	0.17	0.83	-0.35	-0.35	-0.28	1.00					
Health grant.....	-0.08	0.40	0.14	0.21	0.30	0.37	-0.12	1.00				
Welfare grant.....	0.03	-0.32	-0.28	-0.06	-0.09	-0.39	0.05	-0.06	1.00			
Natural resource grant.....	-0.28	0.13	-0.17	-0.13	-0.08	0.17	-0.37	0.17	0.01	1.00		
Pupil/teacher ratio private schools.....	-0.42	0.28	-0.10	0.19	0.22	0.54	-0.28	-0.07	-0.26	0.21	1.00	
Pupil/teacher ratio public schools.....	0.08	-0.24	0.13	-0.36	-0.40	-0.40	0.34	-0.29	0.15	-0.27	-0.05	1.00
Doctors' income per capita..	0.46	0.91	0.70	0.35	0.45	0.75	0.30	0.44	-0.32	0.07	0.37	-0.20

* Untransformed data

Source: Computed from data intemized in Appendix B.

APPENDIX D

TABLE 3

Coefficients of Simple Correlation, Expenditure Categories and Variables Entering Regression Equations, 10 Provinces, 1962-1964*

	Health	Sanitation	Social Welfare	Education	Trans-portation	Natural Resources	Debt Charges	General Government	Protection	Recreation	Other	Total Expenditure
Population growth.....	-0.07	0.59	0.40	0.22	0.04	0.09	-0.35	0.34	0.64	0.24	0.31	0.32
Personal Income per capita.	0.40	0.86	0.03	0.83	0.39	0.47	-0.41	0.71	0.92	0.90	0.48	0.87
Value added per capita.....	-0.09	0.58	0.02	0.35	-0.04	0.01	0.08	0.52	0.75	0.37	0.53	0.41
Natural resource revenue...	0.54	0.76	0.39	0.52	0.17	0.51	-0.74	0.41	0.76	0.64	0.39	0.62
Total non-tax revenue.....	0.47	0.66	0.25	0.74	0.44	0.59	-0.84	0.42	0.75	0.82	0.37	0.77
Motor vehicles per capita..	0.30	0.55	-0.28	0.86	0.58	0.47	-0.48	0.45	0.67	0.94	0.31	0.77
Population density.....	-0.50	-0.11	0.06	-0.23	-0.19	-0.47	0.63	0.18	-0.01	-0.32	0.25	-0.16
Health grant.....	0.56	0.31	0.02	0.40	0.22	0.22	-0.11	0.32	0.35	0.39	0.13	0.47
Welfare grant.....	0.12	-0.29	0.74	-0.33	-0.10	0.30	0.07	0.16	-0.34	-0.36	0.11	-0.10
Natural resource grant.....	0.21	-0.07	-0.11	0.03	0.10	0.65	-0.00	0.15	-0.05	0.15	-0.01	0.10
Pupil/teacher ratio private schools.....	-0.22	0.20	-0.40	0.33	0.30	0.16	-0.14	-0.01	0.23	0.42	0.03	0.17
Pupil/teacher ratio public schools.....	-0.24	-0.01	-0.21	-0.50	0.14	-0.68	0.43	-0.28	-0.37	-0.43	-0.56	-0.40
Doctors' income per capita.	0.28	0.65	-0.16	0.83	0.39	0.36	-0.23	0.63	0.87	0.86	0.57	0.81

* Data in logarithmic form.

Source: Computed from data intemized in Appendix B.

APPENDIX D

TABLE 4

Coefficients of Simple Correlation Between Independent Variables Entering Regression Equations, 10 Provinces, 1962-1964*

	Population Growth	Personal Income	Value Added	Resource Revenue	Non-tax Revenue	Motor Vehicles	Population Density	Health Grant	Welfare Grant	Natural Resource Grant	Private Pupil/ teacher Ratio	Public Pupil/ teacher Ratio
Population growth.....	1.00											
Personal income per capita..	0.43	1.00										
Value added per capita.....	0.75	0.62	1.00									
Natural resource revenue....	0.60	0.67	0.39	1.00								
Total non-tax revenue.....	0.42	0.72	0.21		1.00							
Motor vehichles per capita..	-0.02	0.78	0.17	0.45	0.73	1.00						
Population density.....	0.40	-0.11	0.58	-0.35	-0.48	-0.43	1.00					
Health grant.....	-0.06	0.42	0.15	0.34	0.39	0.37	-0.26	1.00				
Welfare grant.....	0.00	-0.33	-0.29	-0.02	-0.10	-0.43	0.10	-0.08	1.00			
Natural resource grant.....	-0.44	0.07	-0.30	-0.08	0.05	0.27	-0.50	0.23	0.17	1.00		
Pupil/teacher ratio private schools.....	-0.15	0.32	-0.04	-0.01	0.27	0.61	-0.21	-0.01	-0.24	0.29	1.00	
Pupil/teacher ratio public schools.....	0.11	-0.30	0.01	-0.37	-0.46	-0.42	0.48	-0.28	0.04	-0.41	-0.05	1.00
Doctors' income per capita..	0.30	0.89	0.65	0.48	0.61	0.82	0.02	0.45	-0.40	0.09	0.45	-0.33

* Data in logarithmic form.

Source: Computed from data itemized in Appendix B.

APPENDIX E TABLE 1

Mean and Standard Deviation of Independent Variables Entering Regression Equations, 10 Provinces, 1962-64

	Mean	Standard Deviation
Population growth (%)	21.96	10.83
Personal disposable income per capita ($)	1,409	307
Value added per capita ($)	399	292
Natural resource revenue per capita ($)	23.18	36.65
Total non-tax revenue per capita ($)	67.33	47.41
Motor vehicles per capita (No.)	0.32	0.07
Population density	60.56	43.66
Health grant per capita ($)	23.32	2.17
Social welfare grant per capita ($)	9.91	2.83
Natural resource grant per capita ($)	1.79	2.15
Pupil/teacher ratio, private schools	18.21	3.88
Pupil/teacher ratio, public schools	25.69	1.92
Doctors' income per capita ($)	13.04	4.10

Source: Computed from data itemized in Appendix B.